DR. S.N. LINZON

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REPORT OF THE LEAD DATA ANALYSIS TASK FORCE

Ministry of the Environment

Hon. George A. Kerr, Q.C., Minister

Everett Biggs, Deputy Minister

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GLOSSARY OF TERMS

Analysis of Covariance—A statistical test of the difference between two adjusted means. The adjustments are based on a linear relationship with a confounding variable.

Centroid—Geometric centre. The 'centre of gravity' of an irregularly shaped area.

Chi-square—A statistic used in testing the difference between the distribution of frequencies in discrete categories for two or more independent samples.

Collodion—A liquid that dries rapidly to form a plastic 'skin'.

Discrete—Separate, distinct.

Epidemiology—Study of the distribution and determinants of disease in the community setting.

F-test—A statistical test of the equality of two variances.

Geometric Mean—The retransformed mean of a logarithmically transformed variable. The best measure of the centrum of a positively skewed distribution.

Histogram—A form of graphic presentation of frequency Distributions. bars are drawn over the class intervals with areas proportional to the frequencies of the classes.

Lancet—A short, flat needle used to make a small wound in the finger, in order to obtain a 'micro' sample.

Macro—Venous (10 ml) Blood sampling method.

Micro—Pinprick (100 microlitres) Blood sampling method.

Multiple Regression—Statistical method of determining the best relationship between one variable and a set of others.

Natural Logarithm—The exponent of the power to which e, "the natural number" (2.718 . . .) must be raised in order to be equal to a given number.

Nominal Roll—List of persons tested by City of Toronto.

Phytotoxicology—Study of pollution damage to plant life.

Standard deviation—A measure of the scatter of a set of data. The square-root of the average of the squared deviations from the mean.

T-test—Generally a statistical method comparing a sample estimate with the population value but specifically in this report it is used to compare the differences between means

Universal Transverse Mercator—System of geographic measurement similar to latitude and longitude, but expressed metrically.

SUMMARY AND CONCLUSIONS

Summary

Between May, 1973 and November, 1974 some 7,000 people living close to three Toronto lead processing plants, or in a specially designated 'control' area, had blood samples taken for analysis of lead content.

Around the lead plants 194 persons (3.2% of the 6,110 tested) were found to have blood lead concentrations of 40 or more micrograms per 100 ml. In the Control Area the corresponding number was three (0.3% of the 982 tested).

Individuals with a high reading were interviewed along with other persons living in the same house who had had blood tests; the house was inspected and samples of paint, dust, tap water, etc. taken for analysis of lead content. The same procedure was followed in a neighboring house, thus providing an approximately equal number of 'match controls', and also in 133 randomly selected houses in the control area.

Mean blood lead levels as well as the proportion of tested individuals showing elevated blood lead levels decreased with increasing distance from the lead plants. Regression analysis also indicated a statistically significant relationship between blood lead levels and distance from the plants, and this persisted even when other variables such as age and sex were taken into account.

When subdivided into males and females, children (0-14) and adults (15+), there were some inconsistencies. Thus, the decrease of blood lead with distance was statistically highly significant in some groups but in others failed to achieve statistical significance. In particular, adult females showed little evidence of excessive absorption, with only six readings over 40 (0.5% of the 1,255 tested) in the three plant areas.

Correlations between blood lead levels and concentrations of lead in topsoil were, in general, similar to those seen between blood lead levels and distance. In general, children who lived in an area where the soil lead level is greater than 1,000 ppm have statistically significantly higher mean blood lead levels than do children who live in areas where the soil lead level is less than 600 ppm.

Examination of the personal and environmental data in the high, match and control houses did not reveal any coincidental gradients of non-industrial sources of lead with distance from the three plants.

There was little or no evidence that household dust was a major pathway of lead absorption in the high cases, indeed the only potential source of lead that showed consistent and 'biologically plausible' differences between high, match and control houses was soil.

There was some evidence that poor housekeeping and hygiene as well as flaking paint and plaster were more frequently reported in high houses than in match houses.

Unfortunately, suitable data on suspended particulate (respirable) lead were not available in sufficient detail to permit analysis. Lead in dustfall, sampled at seven stations, showed high correlation with lead in topsoil (0-5 cm) and in subsoil (5-10 cm). Analyses in this report have shown a strong relationship between blood lead levels and soil lead levels, but the relation of dustfall to distance or blood lead levels could not be analyzed because of the small number of dustfall sampling stations. Consequently, the relative importance of current (dustfall) to historic (soil) lead levels in the present situation cannot be established.

Conclusions

On the basis of this study it is clear that people living near the three plants studied have an increased risk of acquiring an elevated concentration of lead in their blood.

It is not possible to distinguish clearly between the various possible pathways by which lead has reached affected individuals, however exterior sources of lead such as dustfall and soil rather than interior sources such as paint, water or housedust would seem to be mainly responsible for blood lead elevations in the three plant areas.

CHAPTER 1
BACKGROUND

1.1 Working Group on Lead

The Ontario Government's Ministry of the Environment set up the Working Group on Lead in 1973. Its objectives were to assess the data collected on lead levels near lead processing plants, and to assess the effects of these levels on public health—and then to recommend appropriate courses of action to be taken by the Ministry of the Environment.

In August, 1974, the Working Group prepared an interim report—'Studies of the Relationship of Environmental Lead Levels on Human Lead Intake'—which dealt largely with the data on environmental lead levels around five Toronto lead processing plants.

After noting that the five plants considered in its report "have contributed, and still are contributing to lead contamination of the environment in excess of the degree of contamination found in urban areas due to other industrial sources", the Working Group went on to make 14 recommendations *(see Appendix 1A).*

1.2 Lead data Analysis Task Force

As a continuation of the Working Group on Lead's activities, a formalized Task Force was set up in early 1975 consisting of some members of the Working Group on Lead, as well as representatives from the city of Toronto department of Public Health and from the University of Toronto. The Task Force began its work in April, 1975, under the chairmanship of Dr. Gordon Martin, Executive Director of the Ontario Ministry of Health's Community Health Division. The specific terms of reference of the Task Force are shown in *Appendix 1B.*

The principal objective of the Task Force was to produce this report on the relationship between blood lead levels and environmental data in an attempt to determine the pathways by which environmental lead reached individuals found to have elevated blood leads in these surveys. To do this, the Task Force used data accumulated from surveys conducted by the City of Toronto Department of Public Health.

These data, which included both personal and environmental information, were subsequently adapted for computer input—and the computer file formed the material for analysis by the Task Force.

A large part of the work of this Task Force was related to verifying and merging data from these two sources—blood lead determinations and epidemiological data.

While a preliminary analysis of the blood lead data was given in the Working Group's interim report, a more thorough and detailed analysis was performed in an attempt to confirm or deny the gradient of blood leads with distance from the plants reported previously. Analyses were also carried out to determine whether gradients found in blood lead levels were parallel to gradients in lead levels found in paint, water or elsewhere in the environment. Further analyses were to be performed if gradients were confirmed and found not to be artifacts, in order to determine whether or not there was any indication of the pathways by which lead reached the humans tested.

1.3 Other Activities Related to Lead in the Environment in Ontario

Soon after the Working Group on Lead delivered its report to the Minister of the Environment, another report on lead was presented (in October, 1974) to the Minister of Health.

This second report, titled 'Effect on Human Health of Lead from the Environment' was prepared and submitted by a committee chaired by Dr. H. Rocke Robertson*.

The Environmental Hearing Board, an independent body created by the Ministry of the Environment in April, 1972 was authorized and directed in November, 1974 by Order-in-Council "to hold public hearings regarding the report . . . by the Working Group on Lead, and the report . . . by the Committee to Inquire into and Report upon the Effect on Human Health of Lead from the Environment".

The Board began its series of public tribunals on the topic of lead in December, 1974, since which time it has heard testimony from physicians, psychologists and environmentalists as well as from representatives of lead companies and members of the public.

*Committee to Inquire into and Report upon the Effect on Human Health of Lead from the Environment, D.A. Chant, F.A. DeMarco, and H.R. Robertson, October 29, 1974, Ministry of Health, Province of Ontario.

CHAPTER 2
SAMPLING PROGRAM

In September, 1972 the Ministry of the Environment received a complaint from a resident of Niagara Street that dust from Toronto Refiners and Smelters (TRS) was falling on his backyard table.

The dust was analyzed and, since 3.2% by weight was found to be lead, the complainant and his family were offered analyses of their blood lead levels to better assess any hazard to their health from the lead in the family's environment. The results of these analyses showed that some family members had elevated blood lead levels, a fact which prompted further sampling of neighbors and, as further elevated lead levels were found, representatives of the Ministry of Health discussed the situation with the Medical Officer of Health of the Local Board of Health of the City of Toronto.

The Medical Officer of Health then conducted further blood lead sampling in the TRS area, and this enlarged sampling program showed a further small number of elevated bd lead levels. Because there were other lead plants in the City of Toronto it was considered that the results obtained from the blood lead sampling program around TRS justified extending similar programs to residents in the area of the other lead plants.

Accordingly, the City used as its sites for sampling and study three Toronto locations in which lead plants were located, and one Control Area.

The environmental and blood lead data which would be eventually analyzed by computer came from the four geographic locations mentioned, and were collected over a two year period.

2.1 History of Blood Sampling Program

The City started its blood sampling program in September, 1972, in an area of Toronto in which one of the three lead processing operations, Toronto Refiners and Smelters, was located.

Sampling in this area was done on a house-to-house basis; in the other three locations special clinics were set up.

Physicians, aided by public health nurses with prior instruction, took 10 ml. venous blood (macro) samples from 28 people in this initial test, following it up with samples from a further 28 people in March, 1973.

In May, 1973, the blood sampling process was stepped up considerably with 263 samples being collected over a six-day period; on this occasion, so that the techniques could be compared, the pin prick—micro—method (100 mcl) was used as well as the 10 ml. (macro) sample on approximately 190 of the participants *(see Appendix 2A)*. Young children underwent only micro testing.

In the same month, as the result of a request from a local residents' association, a further 42 micro samples were taken by Dr. D. Parkinson, a member of the staff of Toronto's Hospital for Sick Children, again with the aid of public health nurses.

Through the summer and early fall of 1974, further sampling yielded, by the end of September of that year, a total of 719 micro tests in the TRS area.

In the Canada Metal area there was again considerable community support spearheaded by the residents' association. The residents' association alerted public interest in lead-related matters by holding discussion meetings, distributing printed information and providing some marshalling and organizational help during sampling operations at various local schools.

Letters *(see Appendix 2B)* were sent out to parents in the area drawing attention to the fact that "there appears to be a higher than usual content of lead in the soil" in the neighborhood, and asking parental consent "to take a few drops of blood from a finger prick of your child to test for lead". Most such letters were signed by the school principal and by the deputy medical officer of health for the City of Toronto.

The letters also stressed that anyone of any age could take part in the sampling procedure—not just the children in the school in which tests were being done, although the overwhelming majority of samples came from schoolchildren.

In any event, 2,584 blood samples were taken in the Canada Metal area between October, 1973 and November, 1974. Public health nurses performed the actual blood sampling procedure.

By the time testing got underway in the area where the Prestolite factory was situated, the local residents' associations were able to distribute a flyer *(see Appendix 2C)* containing the information that "tests conducted near two other lead producing factories show that some residents have abnormally high blood lead levels". After noting that "there seems to be cause for concern, (but) . . . not cause for alarm" the flyer goes on to describe the testing process and the clinic locations and times.

The first clinic to be held in the Prestolite area was also announced in a Toronto Department of Public Health form letter which, like the ones distributed in the other areas, briefly described the reasons for the blood lead survey, invited anyone who wanted to take part in the testing to do so, and advised that test results would be made available to each participant by mail.

In all, 5,039 samples were taken in the Prestolite area between December, 1973 and November, 1974.

The Control Area selected was contiguous to the Canada Metal zone, and the same nurses conducted

sampling in both areas. A total of 1,379 blood samples were taken in the Control Area between January and August, 1974.

2.2 Blood Sampling Procedural Details

The clinic testing program in the schools entailed not only the approval of appropriate school boards, and written consent from parents of children to be tested, but also a set of procedural details *(see Appendix 2D).* This was disseminated by the divisional office of the City's public health department and included information about pre-test meetings with school and community representatives, physical accommodation for testing, the necessary supplies, the sampling routine, staff requirements, recording mechanisms and follow-up.

Appended to this document was a set of diagrams on the collection of blood samples for lead analysis prepared by the U.S. Department of Health, Education and Welfare's Childhood Lead Poisoning Control Branch *(see Appendix 2D).*

An indication of the City of Toronto document's comprehensiveness is its section on Supplies. These are listed as: Micro testing kits, including alcohol swab, lancet and gauze square; blood lead data forms; bandaid pachettes; collodion; nominal rolls for checking participants; hand-washing supplies; plastic sheets to protect tables; lab coats for physicians and nurses; scissors; large desk for clerical staff, and half a dozen other items down to the number of chairs and wastepaper baskets that would be needed.

The actual test procedure was as follows: a community volunteer called the pupils to the testing room with their teacher; pupils washed their hands which were then inspected; the teacher handed each pupil the signed parental consent form which the pupil then passed on to the tester.

The nominal roll was then completed for each person to be tested—surname, forename, sex, age, address, telephone number, and language spoken. Following this, the individual's name was handwritten on a label which was then attached to the outside of a test tube containing separate capillaries for the two micro blood samples.

The nurse then thoroughly cleaned the tip of each individual's finger with an alcohol-soaked cotton-wool swab, grasped the finger firmly and made a swift 'pin-prick' incision using a sharp, disposable lancet. The drop of blood that welled up above the wound was allowed to run into the first and then the second capillary tubes, care being taken to ensure that no bubbles entered the tubes, and that the blood was not allowed to run past the volume marks. Both capillaries were then capped and placed inside the large, labelled tube. *(Note: The capillary tubes were not marked in any way to indicate which was first and which was second.)*

At some of the early clinics a collodion 'skin' was applied to the finger before making the incision. This was to protect the blood against possible contamination by dirt on the finger. However, it was found that this procedure was not superior to vigorous cleaning of the finger, and it was therefore discontinued.

The tubes were finally placed sequentially in boxes of 50 for testing by ESA (Environmental Sciences Associates, Inc., Burlington, Mass.) Laboratories; each tube bearing its sample number, the name, address, age and sex of the person tested, and a space to record lab results.

The nurses doing the testing were themselves tested for competence in handling the sampling procedure before embarking on the clinic program. This was done on a cross-check basis in which nurses A and B tested Nurse C; B and C tested A and so on.

After analyzing the blood samples, ESA Laboratories sent the results to the City of Toronto's Department of Health.

Results which were well over 40 mcg were phoned directly to the City's public health department. The department advised people with readings of 40 mcg or over to see their private physician or to consult the Hospital for Sick Children for follow-up study.

After processing (see Ch. 4) the results were then distributed to district offices of the City of Toronto's Department of Public Health and to the City printing department so all participants could be informed of their blood lead levels.

A letter to participants *(see Appendix 2E)* thanked them for their co-operation in the survey, noted the individual's blood lead level, and concluded by stating that: "In surveys by the Ontario Government, the blood lead levels, in mcg per 100 ml., of most people tested were in the following ranges: rural residents—from 5 to 15; city residents—from 5 to 30".

Persons with blood lead levels from 30 to 39 mcg/100 mls were advised to have a repeat blood test at the next clinic testing session.

A copy of the printout, with names and addresses deleted, was sent to the Ontario Ministry of Health.

2.3 'Epidemiological' Questionnaire Part One (Personal)

Initial results suggested a relationship between high blood lead levels and proximity to lead operations; however, it was recognized that there are other environmental and personal factors that might affect the blood lead level. These were investigated in a study conducted in parallel with medical follow-up of the individuals with high blood lead levels.

Part One of the epidemiological survey began in June, 1973, and was conducted by public health nurses visiting those houses whose occupants had already undergone blood testing and were found to have high values.

The nurses completed questionnaires for all such members of a household, and this was done on a personal interview basis that entailed evening visits to houses where one or more residents worked during the daytime. The completed forms were then sent to the Deputy Medical Officer of Health for the City of Toronto.

The forms themselves evolved during the period of the survey *(see Appendix 2F):* to the original (June, 1973) version were added questions on the quality of housekeeping, and on gasoline sniffing (November, 1973); on smoking (December, 1973); on the type of

heating used, and whether the house had a backyard (January, 1974).

In June, 1974, a number of further additions were made, and the questionnaire, in its final form, *(see Appendix 2G)* was adapted for computer input.

The nurses who visited homes to complete Part One of the epidemiological questionnaire were employed in district offices of the City of Toronto's Department of Public Health whose Division of Public Health Nursing was issued with written instructions on general procedures for the Lead Investigation Program.

The purpose of the home visits was not only to complete the Part One questionnaire but also to discuss with the family the blood test results, to advise the family that a public health inspector would also be visiting to conduct Part Two of the epidemiological survey questionnaire, and to discuss recommended follow-up procedures, if any.

In general, the nurses made prior appointments for their visits; before leaving, they gave out a copy of the Department of Health's pamphlet *Worried About Lead? (see Appendix 2H)* which provided advice about protecting the family from the dangers of excessive lead intake and described the early symptoms of lead poisoning.

The first epidemiology Part One survey was conducted in the Toronto Refiners and Smelters (TRS) area starting in June, 1973; when the Canada Metal (CM) area was surveyed, nurses who had worked in the TRS Area assisted and there was similar personnel cooperation from the CM Area to the Prestolite (Pr) and Control areas (CA).

Survey results in the first three areas were transcribed to forms that had not been designed for computer processing; later, this information was retranscribed to the computer form. All surveys in the Control Area used the final version of this form—the one designed for computer use.

2.4 'Epidemiological' Questionnaire Part Two (Household)

Part Two of the epidemiological survey was carried out by public health inspectors from the Department of Public Health's Food Control and Sanitation Division.

There were 41 inspectors who, trained by their supervisors in the collection of household samples and the completion of questionnaires, worked in pairs—one filling out the forms while the other took samples of dust, paint, water, soil, etc.

The forms they used developed through three phases: the original, used in surveys of some 30 to 40 houses in the TRS area in July, 1973 was simply a half sheet of paper; the second form, developed in November, 1973, was a more detailed version of the first, and was used in surveys of 200-300 houses. It was a two-page questionnaire that required information about plaster and vegetation in addition to the dust and paint samples required to complete the original form; the third, and even more detailed, questionnaire was designed for computer input, and was used from August, 1974.

In fact, before the inspectors were issued with this third and final form, they each received a 15-page guide to its completion (see Chapter 7). The guide explains the various definitions and codes used in sampling. The inspectors were also given a set of procedures for the actual survey process clarifying some of the prerequisites to filling out the 42-point questionnare: for example, the necessity of getting permission for the survey of each house from a responsible occupant or owner.

In addition to surveying each household containing one or more persons with a blood lead of 40 mcg/100 ml or more, the health department personnel carried out the same procedure on nearby houses in which no elevated blood leads had been found. These 'matched control' houses were selected mainly on the basis of their proximity to the 'case' houses and of similarity in age, state of repair, etc. Where there was more than one control house to choose from, priority was given to the house containing a child or adult of similar age to the 'case'. At the other extreme, there were a few situations in which several 'case' houses were clustered together, and it was not possible to obtain an equal number of 'matched control' houses within a reasonable distance. The total numbers of 'case' and 'matched control' houses were therefore not exactly the same in each area.

In the Control Area, one or more persons had been tested from approximately 400 houses, but there were only three instances in which a blood lead of 40 mcg/100 ml was found. Detailed 'epidemiological' surveys were carried out on these houses, and on 150 of the houses in which blood levels of less than 40 mcg/100 ml had been found. The 150 houses were selected in such a way as to yield a reasonably well-balanced sample of the entire Control Area. This was done by marking the location of the 400 tested houses on a large-scale city map, and (following a deliberately randomised procedure), selecting an appropriate number of houses from gagh city block.

The 3,799 samples of dust and paint, etc. collected during the courwe of the household surveys were analyzed at the laboratory of the Ontario Ministry of Health. Soil and water samples (totalling 1,211) were analyzed at the laboratory of the Ontario Ministry of the Environment.

As the results of the analyses came in, they were added to the data already recorded for each household. All unusually high or unusually low results were queried before being finally accepted.

CHAPTER 3

ANALYTICAL TECHNIQUES

All blood lead level determinations made in this study used a micro sampling and analysis system developed by Environmental Science Associates of Boston, Mass.

The method of blood taking is described in Chapter 2 and Appendix 2D. When it arrives at the lab, the sample is blown out of the capillary tube into a numbered 20 mm digestion cell. The capillary is then rinsed with two sequential aliquots of 100 μl. of de-ionized water and blown out with nitrogen each time. An aliquot of 300 μl. of a mixture of 24:24:1 HNO_3:$HClO_4$:H_2SO_4 is then added to the sample in the 20 mm digestion tube. A group of samples is placed on a hot plate and allowed to digest to a colorless state in 20 minutes. Aluminum dikes are then placed around the digestion racks and the samples are digested to dryness in approximately 50 to 60 minutes. The samples are then reconstituted with 4.5 cc of de-ionized water and analyzed using the method of anodic stripping voltammetry.

The total system error, including sampling, preparation and analysis is ± 3.75 mcg/100 mls at the 40 mcg/100 mls blood lead level. A more complete description of the systems appears in a report to the Lab Directors' Conference on Pediatric Lead Poisoning, Department of Health, Education and Welfare, (August 23, 1974) titled *A total system and quality control procedure for micro blood lead analysis by anodic stripping voltammetry* by Matson, Griffin and Sapienza.

Soil samples collected for this study were prepared by the Phytotoxicology Laboratory and analyzed by the Air Quality Laboratory both of the Ministry of the Environment.

After delivery to the lab, the soil samples were air dried for 48 hours, then coarsely screened to remove organic material, gravel and other debris. The samples were then pulverized in a porcelain mortar and pestle and sieved through an 80 mesh screen into screw-top glass jars. For chemical analysis of lead content, approximately one gram of soil was weighed into a 50 ml beaker, and 5 ml of nitric and perchloric acid (4:1) were added. The acids were gently boiled on a hot plate for several hours until nearly dry. The residue was cooled, diluted with water and filtered into a 25 ml volumetric beaker. Volume was adjusted to 25 ml with water, and the lead concentration of this solution was read on a Perkin-Elmer Model 403 Atomic Absorption Spectrophotometer by use of appropriate standards.

The soil analysis technique provides lead level determinations which are accurate within ± 10 per cent.

Water samples in this study were analyzed by the Laboratory Services Branch of the Ministry of the Environment. These samples were preserved with sufficient high purity nitric acid to keep the pH below 1, and stored in plastic containers. Analysis was by flameless atomic absorption spectrophotometry with simultaneous background correction to eliminate possible interferences. This method provides lead level determination with a precision of ± 10 per cent.

If samples are found to have a lead concentration of 30 ppb or higher, they are corroborated by a second method: 200 mls of sample is preconcentrated to 50 ml (after adding 5 ml HNO_3) and the concentrate analyzed by AAS with simultaneous background corrections.

Agreement on such samples, between FAAS and preconcentration AAS, is within ± 10 per cent.

All water samples that are part of drinking water programs are further checked by the corroborative testing of every tenth sample by anodic stripping voltammetry. Conditions of the ASV system are similar to those employed for blood analyses except that no sample preparation is required. The agreement between ASV and FAAS is better than 10 per cent in the 1-50 ppb range.

Household paint and dust samples collected by the City of Toronto were analyzed by the Occupational Health Laboratories of the Ministry of Health.

Ten milligrams of the sample is weighed out and placed in a 150 ml beaker to which 10 ml of nitric acid is added. After covering the beaker with a watchglass, it is heated to just below boiling point, until the sample dissolves or disintegrates (in approximately two to three hours). When the sample is dissolved or disintegrated the watchglass is removed and the solution allowed to evaporate almost to dryness. The sample is then made up to 100 ml with the addition of 1 per cent nitric acid. The solution is allowed to settle and filtered if necessary and is then analyzed by aspiration into the flame of an atomig absorption spectrophotometer equipped with simultaneouw background correction at a wavelength of 217.5 millimicrons.

The instrumentation provides lead level determinations with a precision of ± 0.02 per cent at lead levels of 1 per cent, and ± 0.2 per cent at lead levels of 10 per cent.

The dustfall samples were analyzed for lead by the Air Quality Laboratory.

The sample as collected in the dustfall jar is swilled out with water and poured through filter paper. The deposit on the filter is dried out and weighed. This deposit is dissolved in 5 ml of 1:1 hydrochloric acid: water solution and heated until only 2 ml of the solution remains. Another 10 ml of distilled water is added and the solution heated for a further 10 minutes. The solution is allowed to cool and then water is added to make 15 ml of solution. This solution is analyzed by atomic absorption spectrophotometry to determine the lead content.

The analysis technique provides lead level determination which are accurate within ± 4 per cent.

CHAPTER 4
DATA PROCESSING

4.1 Creation of Data Files

4.1.1 Blood and Epidemiology Data

Using typewriter terminals linked directly to magnetic disc storage, the City of Toronto transferred all of its accumulated lead data to the computer.

So far as the blood samples were concerned there were two separate inputs: the data from the nominal roll and the laboratory results themselves.

Nominal roll data, programmed through an IBM Time Sharing Option package program, included name, age, address and sex. The computerized information was then checked against the original handwritten nominal rolls, and changes, additions and deletions made where necessary—and before laboratory results were keyed in.

As the blood lead levels were received from ESA laboratories the operators keyed these into the nominal rolls for each clinic date, after checking that sequences of names and test results matched. Where discrepancies were found the computer flagged them, and the operators made the corrections by referring again to the original nominal roll.

Having aligned the name, address, age and sex of each person seen on a given clinic date with that individual's blood lead level, the computer then stored all of this information along with the following coding: 0 for blood lead levels below 30 mcg/100 ml; 1 for levels between 30 and 39; 2 for 40 mcg or above; 3 for no average result due to both the capillary tubes having been broken; 4 where there was a variation in the two readings of more than 17 mcg*; and 5 where there was only a single capillary reading.

A slightly different approach was taken for the Toronto Refiners and Smelters area which required an extra transcription. Here, the lab results were transcribed onto sheets listing information contained on the nominal roll and then keyed through a computer terminal onto magnetic disc.

The data were then subjected to close scrutiny to check their validity: for example, did the street and house number actually exist in the City of Toronto? This was verified by referencing a computerized disk file with all streets on it. Then, clinic dates were checked, and finally, the blood values themselves. There were generally two blood values for each participant. Provided that the difference between the two values was not more than 16 mcg per 100 ml, the values were averaged and the average became the accepted blood value.

*Original ESA recommendation 17 mcg—subsequently lowered on ESA suggestion to 16 mcg.

After the computer printouts had recorded each participant's surname, age, street, and blood lead level, the Chief Clerk of the Public Health Dept. undertook further checking of the data. He ensured, for instance, that sex matched forename; he checked that surnames listed for any given address were consistent both in sequence and in spelling. Whenever he ran into doubtful information, this was double checked against the nominal roll, the parental consent forms, the telephone directory—or by phoning the family directly. Any corrections were made in red marker on the printout and re-keyed into the terminal, which produced a revised printout that was also checked for its accuracy.

To this information was added the individual's postal code, and batches of the final computerized results were subjected to clerical scrutiny as a further test of accuracy.

As each new batch of results for a particular clinic date was considered 'clean' it was merged with similarly scrutinized and corrected data from previously-held clinics; however, despite this merging, computer storage still allowed for retrieval of any given record by clinic date.

The next computer operation was to determine, for each record listing a house within the city limits, its unique UTM (universal transverse mercator) grid coordinate from a street and address computer file maintained by the City.

People who were tested on more than one occasion (such as those whose initial readings were over 30 mcg) had their second and subsequent results added to their initial file entry.

The computer input process for the epidemiological surveys (Parts One and Two) also used the IBM Time Sharing Option package and involved three separate keying operations.

The tapes carrying blood data were then merged with epidemiological (Part One) tapes, and a listing produced showing cases where: 1) There was an 'epidemiological' report for a house for which there was no blood test data; 2) a person's age differed by more than two years between the dates of the blood test and the epidemiological questionnaire; or 3) there was a sex difference in reports on records with the same name.

Following this listing, each house listed on the final merged tape was given a second identification number so that a separate tape—on which names and addresses had been eliminated—could be provided to the Government of Ontario.

After the City of Toronto had merged blood lead re-

sults and epidemiological (Part One) data, the Lead Data Analysis Task Force merged all three segments of the study—blood, epidemiological (Part One) and epidemiological (Part Two).

4.1.2 Phytotoxicology and Air Quality Data

The Task Force developed computerized storage and retrieval for the phytotoxicology (soil and vegetation) data; air quality (and meteorology) data were extracted from the existing Ministry of the Environment computerized data bank.

There were two separate collections of 'phyto' samples—in June and October, 1974—for the Canada Metal, Toronto Refiners and Prestolite areas; and one only, in October, for the Control Area.

There were three different categories of samples: these were from tree and shrub foliage, from grass and from soil. The first two groups were tested either in washed or unwashed form, and the third group (soil) in unwashed form only. There were two separate types of soil sample—those taken from a depth of 0-5 cm., and those from 5-10 cm., although both were taken with the same auger.

4.2 Data File Editing and Verification

4.2.1 Data Editing

As described in section 4.1, several built-in checks were incorporated into the data processing so that error would be minimal. Everything keyed into the computer was double-checked: for example, before being put on tape, items such as whether blood data had been matched to the correct individual were scrutinized, and corrected if necessary. Information on the epidemiological (Part One) questionnaire went onto a separate file and was merged with blood data.

When the Task Force received the two completed tapes—blood and epidemiological (Part One), and epidemiological (Part Two)—this material went through three checking processes: the first was for internal consistency, such as that on the blood and epidemiological tapes the sex of any given respondent was the same on each . . . or that the age given corresponded to the birthdate of any person interviewed; the second type of edit process was designed to ensure that answers to specific questions made sense: for instance, a response of over 24 to a question about how many hours a day the interviewee spends at home obviously needed investigation, as did replies in which the number of years of residence at a particular address came to more than the age of the person interviewed; the third type of edit was a range check: laboratory results that appeared to be far out of range were further scrutinized to see whether they had been properly transcribed, or whether the sample type was the correct one for a given reading.

After all errors had been corrected, the two tapes were merged using 12-digit identification codes supplied by the City of Toronto. The merged tape was further edited, and the data cross-checked between the two files. For example, the question about whether there was a lead worker in the house had been asked on Parts One and Two of the 'epidemiological' questionnaire, and the answers on each were verified to ensure that they were the same.

At this stage the merged tape was considered to be sufficiently accurate for use in the final data analysis.

4.2.2 Data Verification

The verification process consisted of ensuring that data on file were identical to the information on the original field forms. Since the final file contained information from a variety of different sources, the transcription of each source had to be checked separately. This still left a possible margin of error since the original information might have been wrongly recorded by the interviewer.

The Task Force designed and executed a verification plan in which 180 of the approximately 8,000 first blood tests on cumputer records were checked against the ESA laboratory reports. The rate of error was 2.8 per cent.

Typically, errors were that results for one individual were attributed to another. However, it should be noted that it is very unlikely that any high values would have been wrongly ascribed since persons with readings over 40 were contacted personally, as well as by computer-generated form letter.

Then, 60 of approximately 1,200 epidemiological Part One questionnaires were randomly selected, and checked for transcription accuracy. The error rate was two per cent. Typical errors were: 1) 'No' reported as 'no answer'; 2) 'No' reported as a 'yes'; 3) A complete form not transcribed.

Finally, of the total of about 500 houses surveyed in the epidemiological Part Two survey, 50 were selected and the questionnaire segment checked in the same manner, the original field records being compared with the final computer record. Here, the error rate was found to be less than one per cent. Typical errors were: 1) A 'no' reported as a 'yes'; 2) A 'yes' reported as a 'no'.

The sampling section of the epidemiological Part Two survey was checked against the lab reports and had an error rate of some two per cent, and generally such errors related to wrongly-placed decimal points or to inaccurate coding of sample type, etc.

In addition to the original 50 houses, a further 25 were checked to discern whether the house information was matched to the right people during the merging of the tapes. No errors were found in this merging.

4.3 Computer Analysis Techniques and Procedures

Throughout the analysis of lead data a whole range of tabulation and graphic techniques, basic statistics (T-tests and Chi-squares) and such techniques as multiple regressions and analyses of covariance were used.

Since the data base was so large and complex (approximately 1 million separate pieces of information) computer analysis was obviously necessary. Most of this analysis utilized the Ontario Government's IBM 360-158 equipment at the Queen's Park (Toronto) Computing Centre.

Most of the statistical analysis was done using the well-established *Statistical Package for the Social Sciences*—a simple, convenient, flexible programming system developed at Stanford University. As well as providing a detailed set of procedures for data transformation and file manipulation, SPSS offers the researcher a large number of statistical routines commonly used in the social sciences. The SPSS system has been updated several times since its introduction in 1965.

As well as using this system, the computer operations staff handling the programming of lead data for the Task Force developed various custom programs tailored specificially to this particular body of information. For example, they wrote programs for statistical analysis not available on SPSS, and for a number of the tables and summaries that accompany this report, including, for example, the table of sample types and item codes showing how many samples of each type were collected at each location.

Programs were written to calculate the distance of each house from the centroid and the nearest point on the boundary of the appropriate lead plant.

The Synagraphic Computer Mapping technique (SYMAP) was used to contour soil lead data collected by the phytotoxicology branch, and, as a byproduct, to provide an estimation of the soil lead level at each house.

Developed at Harvard University's Laboratory for Computer Graphics, SYMAP is a computer program for producing maps which show spatially disposed quantitative and qualitative information. It enables its users to assign values to the co-ordinated locations of data points or zones, and can produce variations of contour maps based on the data points.

CHAPTER 5

DESCRIPTION OF BLOOD LEAD STUDY GROUP

5.1 Definition and Demography of Areas

Toronto, a city of some 700,000 inhabitants, is situated on the northern shore of Lake Ontario. It is the centre of a metropolitan area of two million people, is the provincial capital of Ontario, and has divers secondary industries. It is not a primary lead smelting area.

All four of the areas under discussion in this report, namely, those in which the three lead plants are located, and the Control Area, are in the City of Toronto proper. The three lead plants are Toronto Refiners and Smelters (TRS), Canada Metal (CM), and Prestolite (Pr); for these, 'area' is taken to mean a distance of 1,000 metres from each plant's geometric centre. The figure was selected somewhat arbitrarily but a preliminary survey had shown that soil lead concentrations had reached background levels well within this distance. This 1,000 m. radius also included almost 90 per cent of those persons tested. The Control Area is contiguous to the Canada Metal area as shown on the map.

The Toronto Refiners and Smelters plant is situated in an industrialized part of the city with correspondingly less residential area. While a few houses abut onto the plant property most of them are farther away from the plant than is the case in the Canada Metal area.

TABLE 5.1
DEMOGRAPHIC CHARACTERISTICS OF TEST AREAS
BASED ON 1971 CENSUS

	Metropolitan Toronto	City of Toronto	Toronto Refiners	Canada Metal	Prestolite	Control Area
Census tracts (weighting)*	—	—	10(.6) 11(.4)	19	109(.5) 96(.3) 97(.2)	29(.7) 18(.3)
Males: (%)	49.5	49.0	57.5	50.3	50.9	50.4
0-4 years	4.2	3.6	3.4	4.1	5.3	4.5
5-9 years	4.9	3.7	4.0	4.9	5.3	5.7
10-14 years	4.7	3.5	4.2	5.5	4.7	5.3
15 and over	35.7	38.2	45.9	35.8	35.6	34.9
Females: (%)	50.5	51.0	42.5	49.7	49.1	49.6
0-4 years	4.0	3.4	2.9	3.8	5.2	4.5
5-9 years	4.6	3.6	4.0	4.6	5.3	5.6
10-14 years	4.5	3.4	4.4	4.6	4.3	5.4
15 and over	37.4	40.6	31.2	36.7	34.3	34.1
Born in Canada (%)	66.0	56.4	28.8	74.4	42.6	72.6
Mother tongue — English (%)	73.8	61.0	43.4	77.0	44.7	75.4
Ethnic Group:						
British Isles (%)	56.9	45.8	17.3	62.6	23.5	60.7
Italy (%)	10.3	12.6	3.0	3.4	24.2	3.0
Schooling:						
Less than grade 9(%)	37.1	40.2	39.8	52.8	66.1	58.0
Some university (%)	5.2	6.7	2.4	4.0	3.2	3.4
Owner occupied dwellings (%)	54.9	41.8	50.6	63.9	72.1	43.7
Median value ($)	32,408	32,542	26,258	23,167	26,881	21,805
Single dwellings (%) (attached or detached)	63.5	54.0	82.2	84.7	89.2	79.2
Rooms per dwelling (including apartment)	5.6	5.2	6.1	5.5	5.9	5.5
Occupancy less than 1 year (%)	19.1	21.8	17.7	17.2	15.0	19.2
3 years or more	61.5	58.5	63.8	66.9	37.8	60.2
Construction before 1946 (%)	30.7	66.5	92.6	89.9	84.8	82.0
Persons per Household:						
Total	3.3	3.0	4.1	3.7	4.3	3.6
Children (0-14)	1.1	0.9	1.1	1.0	1.3	1.1
Average total income per household ($)	11,912	10,821	9,513	9,207	9,964	7,210

*where a test area involved more than one census tract, the census data have been combined in such a way as to reflect the population distribution.

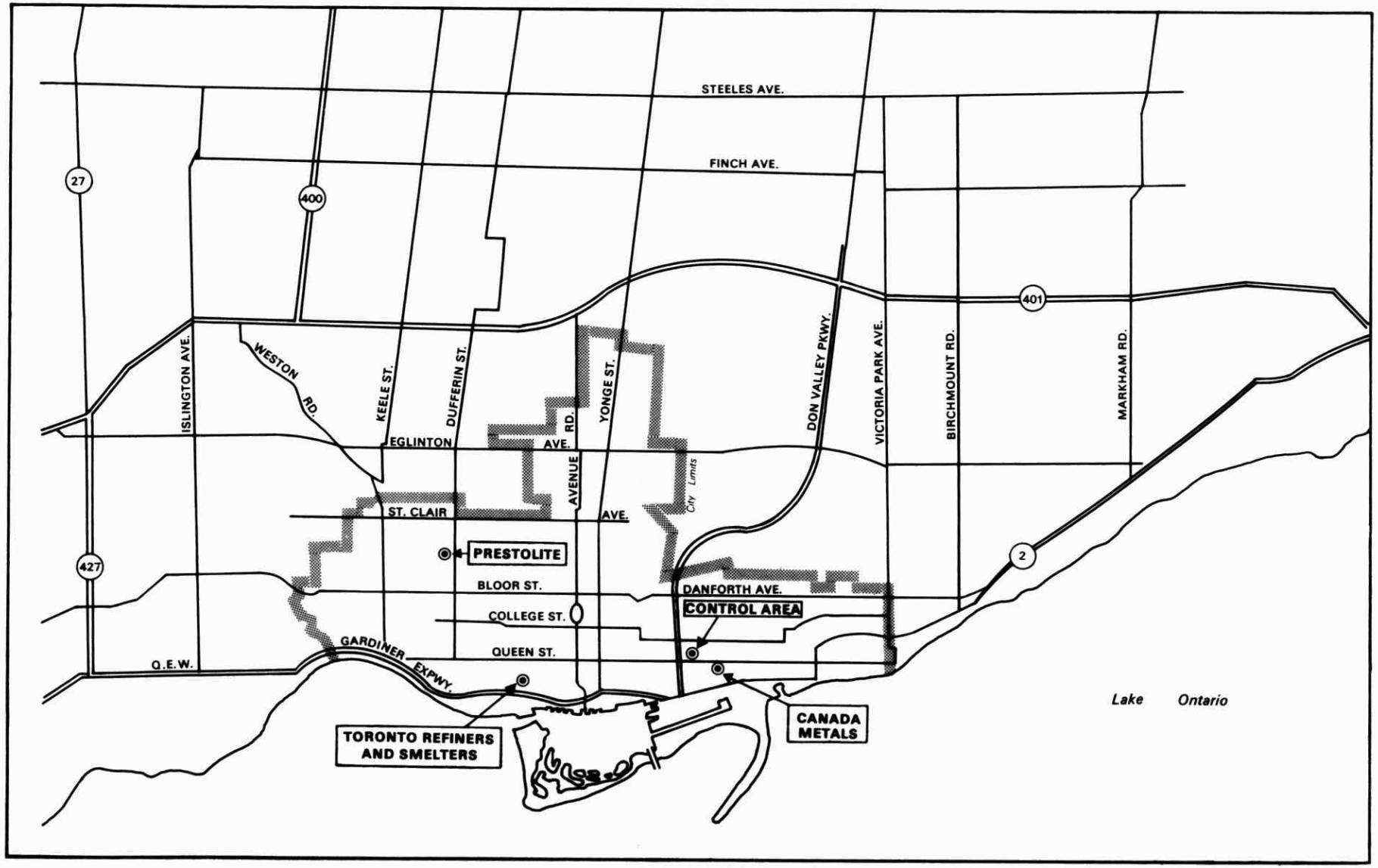


FIGURE 5.1 LOCATIONS OF PLANT AREAS IN METROPOLITAN TORONTO

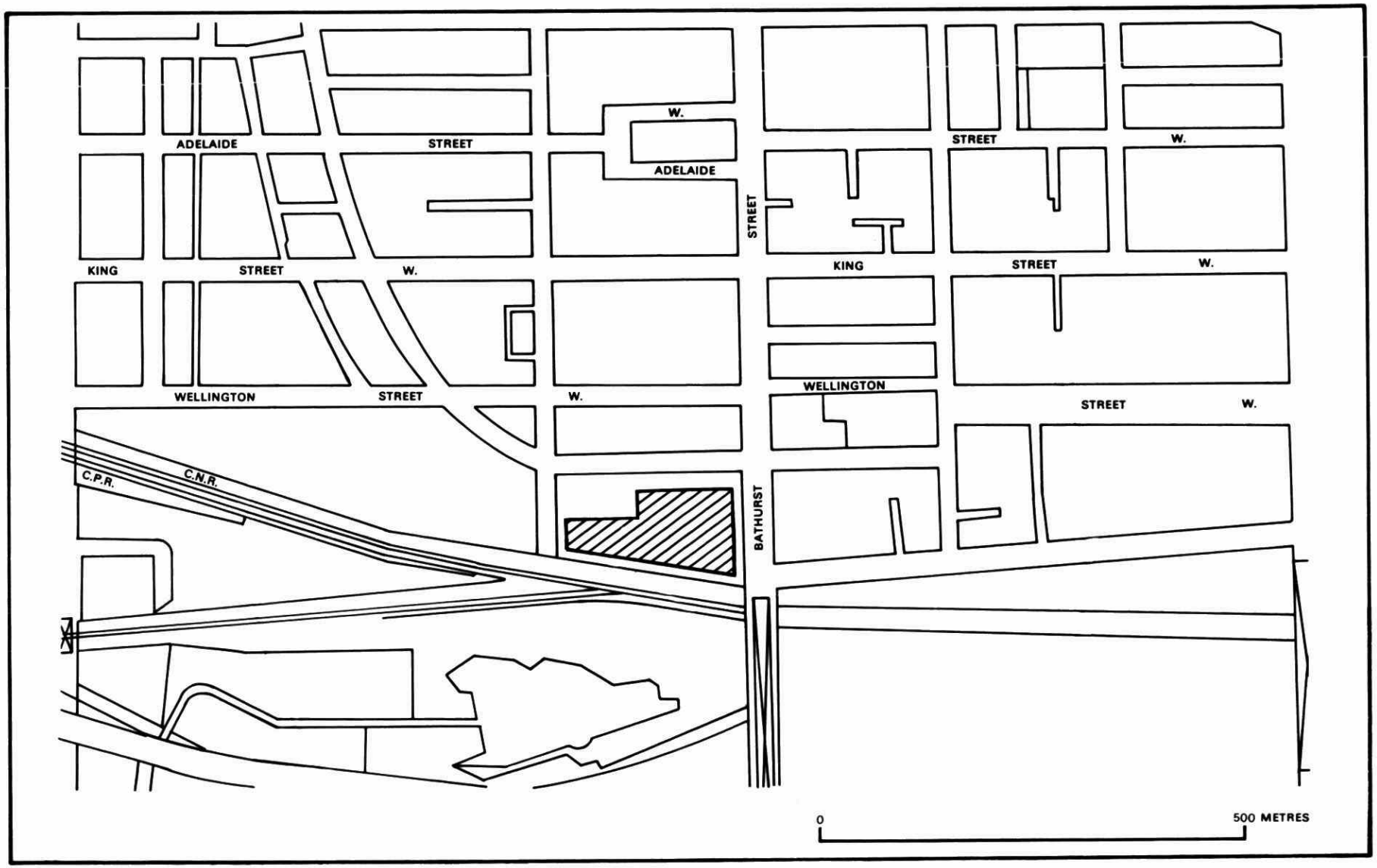


FIGURE 5.2 TORONTO REFINERS AND SMELTERS AREA

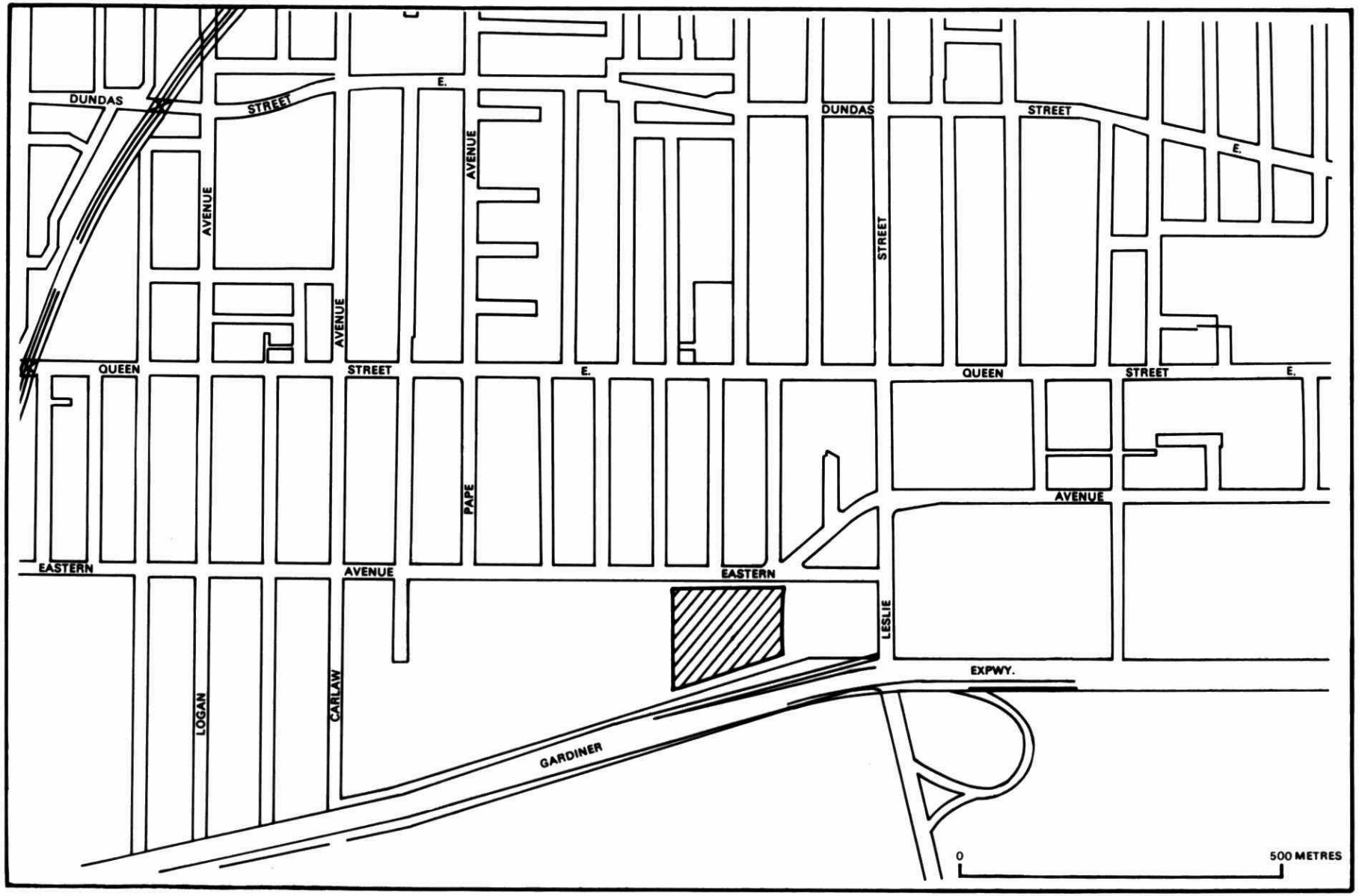


FIGURE 5.3 CANADA METALS AREA

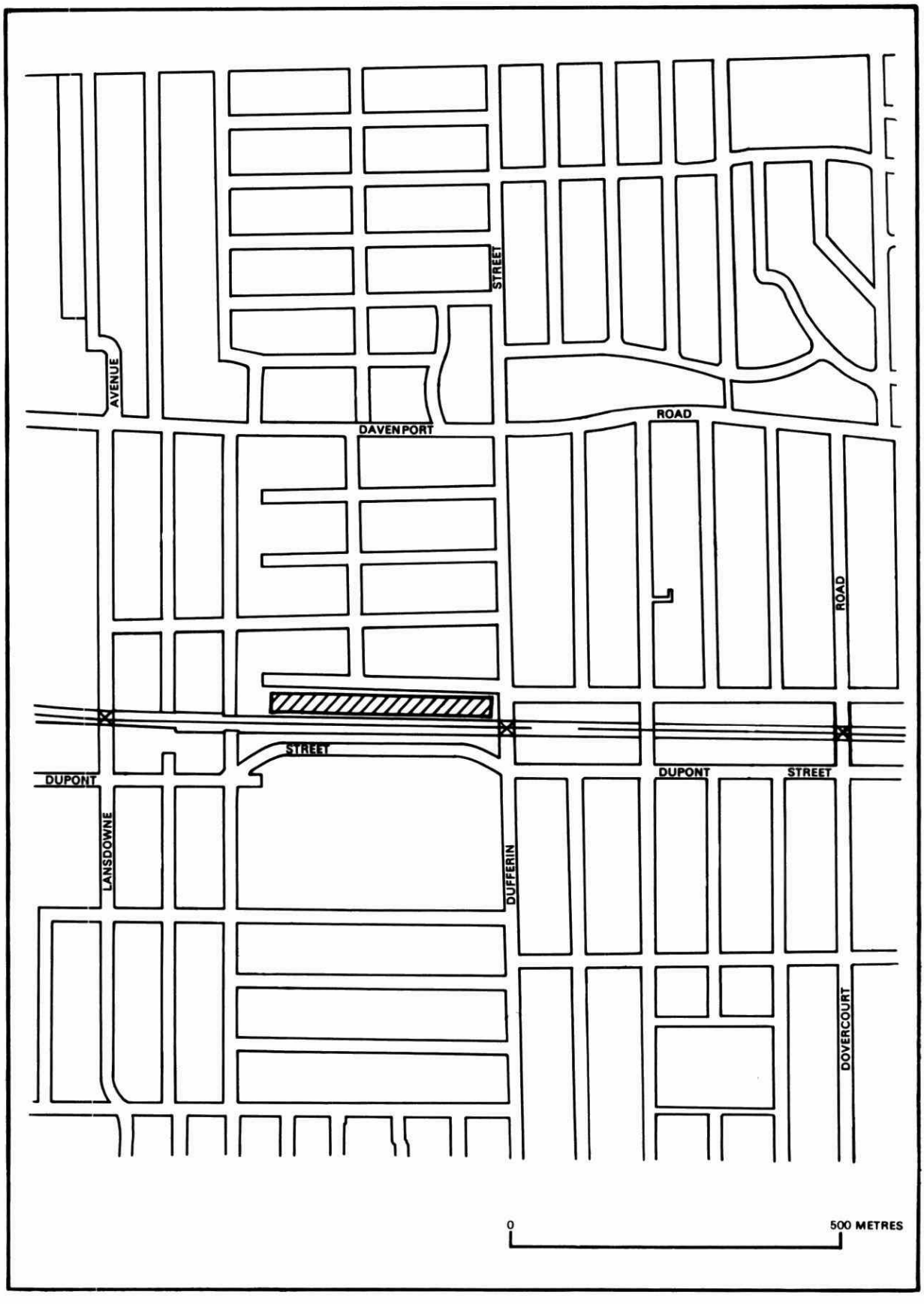


FIGURE 5.4 PRESTOLITE AREA

FIGURE 5.5 CONTROL AREA

The Canada Metal area is bounded on one side by the Gardiner Expressway, a heavily travelled main East-West artery which is elevated to about 10 metres at the point where it passes the plant. The main residential section is on the streets running north from the plant, the housing consisting mainly of older, but generally well-maintained, semi-detached units.

In the Prestolite area which is more compact than the others, there is no housing alongside the plant itself. Houses in the Pr area are generally bigger, and more often detached, than those in the other areas. Some 4,000 people were sampled in this area.

The Control Area was chosen principally because of its similarity to the Canada Metal area—socio-economically, in the age and type of housing, in ethnic composition, etc. In the northern section of the Control Area, houses are mainly semi-detached, and of quite substantial (brick) construction; the southern section consists principally of row housing some of which is undergoing extensive renovation.

Because, historically, the interest in lead poisoning from an epidemiological viewpoint has centred on the occurrence of the disease among residents of dilapidated housing in the inner city areas, studies have tended understandably to concentrate on the housing and population characteristics of affected versus unaffected areas. In Toronto, several possible sources of lead intake were considered, including paint, plumbing, and dust. For these reasons a consideration of the housing and population characteristics of the survey areas is of importance.

Table 5.1 shows that, in general, the three plant areas are similar in their age distributions but significantly different in their ethnic make-up, with the Prestolite and Toronto Refiners and Smelters areas being markedly different from the Canada Metal and Control Areas. The level of schooling and those having some university education is fairly constant across all of the study survey areas as is the average household income with the Control Area showing a somewhat lower level than the other areas.

The age and type of housing are similar in each area, with the Control Area having more housing built after 1946 (18%) than the other areas and having a lower assessed value. The average total income per household was lower in the Control Area where somewhat fewer houses were owner-occupied; but in general the similarities between the housing characteristics of the areas appear to be greater than the differences. None of the areas could be generally described as dilapidated or showing the type of inner city decay associated with a high incidence of lead poisonings.

5.2 Definition of Study Group

Since the blood-testing programs were conducted on a voluntary basis, those persons who took part were a self-selected sample of the total available population.

In the case of young children the selection was, of course, parental so the children who underwent testing were not a statistically pre-selected group; rather, they were schoolchildren whose parents had signed consent forms, or pre-school children brought by their parents to a clinic.

With the exception of the early testing around the TRS plant (where a door-to-door canvass was carried out) the testing in all four areas was based on clinics to which local residents were urged to bring or send their children. Any adult who requested a blood test was given one, but the emphasis on children is reflected in the overall sampling figures which show that a much greater proportion of the available population was sampled from the younger than from the older age groups.

Table 5.2 shows the percentage of people tested in each of the age and sex groups (for method of estima-

TABLE 5.2
PERCENTAGE OF POPULATION TESTED, BY AGE AND DISTANCE FROM CENTROID

Area	Distance (metres)	0-4	5-9	10-14	15+	All Ages
Toronto Refiners	0-199	35	48	63	26	31
	200-399	69	64	38	19	27
	400-599	25	54	64	10	23
	600-799	6	21	38	3	7
	800-1000	5	8	6	1	2
	TOTAL	13	23	27	5	8
Canada Metal	0-199	43	73	62	32	40
	200-399	48	71	60	23	34
	400-599	28	66	52	8	22
	600-799	9	25	27	3	8
	800-1000	1	10	9	1	3
	TOTAL	15	33	30	7	12
Prestolite	0-199	26	97	64	10	26
	200-399	30	86	49	10	23
	400-599	29	71	49	8	23
	600-799	17	42	35	5	13
	800-1000	8	13	10	2	4
	TOTAL	17	42	30	5	12
Control Area		10	52	30	2	11

tion of available population, see *Appendix 5A*). In addition to varying with age, the proportion of the population sampled in the three plant areas also varied with distance from the plant. This was not unexpected since the suspicion that environmental contamination by the lead-processing plants might be responsible for some elevation of blood-levels had been the starting point of the testing programs.

In spite of widespread publicity of the testing program, persons living at a distance from the plants appear to have felt less endangered, and were therefore less likely to come forward for testing or to bring their children for testing.

After the testing had been carried out, the numbers available for the present study have further been reduced because of invalid results (broken tubes or difference greater than 16 mcg per 100 ml*) or because the people tested—school teachers, for example—lived in other parts of Metropolitan Toronto.

The final data have therefore gone through a two-stage selection process: first, self-selection (or parental selection) because the program was voluntary; second, elimination due to procedural errors. The latter involve only a relatively small number of people (457 out of 8,394 or 5.4 per cent), and, since they occurred randomly, their absence from the final data base is unlikely to have introduced any false conclusions. The self-selection process is, however, a cause for concern since it is well-recognized as a potential source of erroneous conclusions in screening surveys. However, provided that the proportion of the population tested is reasonably large, and provided that the age and geographic biases are allowed for, there is no reason to believe that in this study the persons tested were unrepresentative of the total population at risk.

Included in this analysis are only those people whose first blood lead reading was valid (see Ch. 3), and was included on the tape supplied by the City of Toronto to the Task Force. This includes people whose first test was between May, 1973 and November, 1974 inclusive.

For the purpose of this study only the result of a first blood lead level test on each individual was utilized.

While the use of the mean of two (or more) tests where available is superficially attractive, it would lead to error, since: (1) only a minority of persons (14%) had more than one test; (2) repeat tests occurred more frequently in those with an initial blood lead level over 40 mcg than in those with an initial blood lead level below 40 mcg (overall percentages 46 per cent and 11 per cent respectively), and due to the phenomenon of "regression toward the mean" *(see Appendix 5B)* there would be a bias if mean values for the minority were compared with single values for the majority; (3) the mean interval between first and second recorded tests was almost five months, and, since all persons with blood lead levels over 40 mcg had been warned and in some cases treated, there might well have been a substantial decline from the initial values; (4) whatever errors are present in the initial values they are likely to be randomly distributed and their effect will therefore be to weaken any true correlations with distance, etc., not to create correlations that do not really exist.

In this connection, it must be stressed that our data have included only those results obtained at the City of Toronto clinics. What is referred to as a 'second' test in our data may therefore actually be the third, fourth, or subsequent tests for that individual; indeed, some of these 'second' tests may have occurred after hospital admission and vigorous treatment. No meaningful comparisons can therefore be made between the first and 'second' (or subsequent) tests recorded in this data base, except perhaps for those individuals with low initial readings, in whom treatment did not occur, and in whom there is likely to have been only a minimal change in personal habits.

Those people who were tested only by macro (i.e. 10 ml venous blood sample) method, and who did not have a micro test at the same time were not included in the study group but are listed in *Appendix 5C*.

From this point on, wherever a blood lead value is used it refers to a micro test which has met the criteria outlined above.

5.3 Summary of Blood Tests

5.3.1 Valid and Invalid

There was a total of 8,394 people tested; of these, 7,937 were considered to have had valid first blood tests, and 457 (5.4%) to have had invalid ones.

There were three reasons for non-validity: the difference in readings was 16 mcg/100 ml, or greater, (267 cases); in 180 instances one tube was broken, and in 10 cases both tubes were broken.

From the total of 7,937 valid tests a further 845 were excluded because they involved people who did not fall within the defined geographic area for the study (see discussion in Ch. 5.1).

5.3.2. Multiple Testing

Among those who had second tests, a total of 1,181 people yielded 54 invalid tests (4.6%) with an average time span between the first and second test of 19.6 weeks.

Of 323 people who underwent a third test, 12 had invalid tests (3.7%) and the average time between their second and third test dates was 17 weeks.

Seventy-five people underwent fourth tests, of which five (6.7%) were considered invalid—and the average time between tests three and four was 14.2 weeks.

Finally, eight people received a fifth test. None of these tests turned out to be invalid, and the average time between 4th and 5th testing was 12.3 weeks.

These findings are summarized in Table 5.3.

*The original ESA recommendation of 17 mcg was subsequently lowered (on ESA suggestion) to 16 mcg.

TABLE 5.3
SUMMARY OF MULTIPLE BLOOD LEAD LEVEL TESTINGS

Test	Total	Valid	Invalid	% Invalid	Average Time Since Previous Test
1st	8394	7937	457	5.4	—
2nd	1181	1127	54	4.6	19.6 wks.
3rd	323	311	12	3.7	17.0 wks.
4th	75	70	5	6.7	14.2 wks.
5th	8	8	0	0	12.3 wks.

5.4 Sex and Age Distribution of Populations

5.4.1 Classification by Age

In our investigation into the possible pathways of lead we felt it important to look at the possible effects of sex and age on the blood levels of the study participants. This was not only because of the behavioral differences anticipated between boys and girls, but also because there may be some differences in the body chemistry of male and female children. In older age groups, the fact that men are more likely to spend more time away from the home (and might be more exposed occupationally to lead) than are women, might also have a bearing on the results.

For the purposes of this analysis we considered a child to be someone of 14 years or under. In many segments of our study the children were further subdivided into age groups 0-4, 5-9 and 10-14.

The age groupings for adults were generally taken as: 15-24; 25-34; 35-44; 45-plus. In other areas of the study where we felt it would be useful to do so we used the person's actual age.

5.4.2 Comparison of Age and Sex Distribution Between the Study Areas

Tables 5.4, 5.5, and 5.6 provide a summary of the study population and their age and sex distribution by area.

TABLE 5.4
NUMBER OF VALID FIRST TESTS BY AGE GROUP, SEX AND AREA

Combined

Area	Children	Adults	Total	Children %
Toronto Refiners	405	329	734	55.2%
Canada Metal	1096	691	1787	61.3%
Prestolite	2640	949	3589	73.6%
Control Area	872	110	982	88.8%
TOTAL	5013	2079	7092	70.7%

Males

Area	Children	Adults	Total	Children %
Toronto Refiners	194	154	348	55.7%
Canada Metal	543	267	810	67.0%
Prestolite	1313	293	1606	81.8%
Control Area	441	29	470	93.8%
TOTAL	2491	743	3234	77.0%

Females

Area	Children	Adults	Total	Children %
Toronto Refiners	211	175	386	54.7%
Canada Metal	553	424	977	56.6%
Prestolite	1327	656	1983	66.9%
Control Area	431	81	512	84.2%
TOTAL	2522	1336	3858	65.4%

TABLE 5.5
AGE AND SEX BREAKDOWN OF NUMBER OF CHILDREN TESTED

Combined

Area	0-4 yrs.		5-9 yrs.		10-14 yrs.		Total
Toronto Refiners	68	*17%*	151	*37%*	186	*46%*	405
Canada Metal	182	*17%*	471	*43%*	443	*40%*	1096
Prestolite	532	*20%*	1311	*50%*	797	*30%*	2640
Control Area	80	*9%*	515	*59%*	277	*32%*	872
TOTAL	862		2448		1703		5013

Males

Area	0-4 yrs.		5-9 yrs.		10-14 yrs.		Total
Toronto Refiners	33	*17%*	79	*41%*	82	*42%*	194
Canada Metal	85	*16%*	235	*43%*	223	*41%*	543
Prestolite	266	*20%*	667	*51%*	380	*29%*	1313
Control Area	42	*10%*	269	*61%*	130	*29%*	441
TOTAL	426		1250		815		2491

Females

Area	0-4 yrs.		5-9 yrs.		10-14 yrs.		Total
Toronto Refiners	35	*17%*	72	*34%*	104	*49%*	211
Canada Metal	97	*17%*	236	*43%*	220	*40%*	553
Prestolite	266	*20%*	644	*49%*	417	*31%*	1327
Control Area	38	*9%*	246	*57%*	147	*34%*	431
TOTAL	436		1198		888		2522

TABLE 5.6
AGE AND SEX BREAKDOWN OF NUMBER OF ADULTS TESTED

Combined

Area	15-24 yrs.		25-34 yrs.		35-44 yrs.		45+		Total
Toronto Refiners	93	*28%*	83	*25%*	63	*19%*	90	*27%*	329
Canada Metal	201	*29%*	112	*16%*	134	*19%*	244	*35%*	691
Prestolite	203	*21%*	279	*29%*	266	*28%*	201	*21%*	949
Control Area	34	*31%*	23	*21%*	24	*22%*	29	*26%*	110
TOTAL	531		497		487		564		2079

Males

Area	15-24 yrs.		25-34 yrs.		35-44 yrs.		45+		Total
Toronto Refiners	45	*29%*	34	*22%*	26	*17%*	49	*32%*	154
Canada Metal	83	*31%*	35	*13%*	44	17%	105	*39%*	267
Prestolite	67	*23%*	63	*21%*	96	*33%*	67	*23%*	293
Control Area	10	*34%*	4	*14%*	7	*24%*	8	*28%*	29
TOTAL	205		136		173		229		743

Females

Area	15-24 yrs.		25-34 yrs.		35-44 yrs.		45+		Total
Toronto Refiners	48	*27%*	49	*28%*	37	*21%*	41	*23%*	175
Canada Metal	118	*28%*	77	*18%*	90	*21%*	139	*33%*	424
Prestolite	136	*21%*	216	*33%*	170	*26%*	134	*20%*	656
Control Area	24	*30%*	19	*23%*	17	*21%*	21	*26%*	81
TOTAL	326		361		314		335		1336

In each of the study areas the age distribution of subjects was very similar with slightly more children than adults being tested, except for the Control Area in which there was a higher percentage (89 per cent) of children tested, especially in the 5-9 age bracket. The differences in the age distributions were tested statistically (see Table 5.7) and found to be significant. Consequently, age must be considered as a co-variable in comparing the Control Area with other areas.

Within each area the numbers of males and females tested were about equal.

TABLE 5.7
SUMMARY OF SIGNIFICANCE LEVELS OF TESTS
COMPARING AGE DISTRIBUTIONS IN PLANT AREAS TO CONTROL AREA

Area	Children	Adult
Toronto Refiners	***	N.S.D.
Canada Metal	***	N.S.D.
Prestolite	***	*

*Significant at 5% level
***Significant at 0.1% level
N.S.D.—No significant difference

5.4.3 Distance Distribution by Age and Sex

We subdivided the study areas (each of which is bounded by a 1,000 metre radius from the plant centroid) into five separate concentric bands, each 200 metres wide. By taking these subdivided zones (at 0-199 m; 200-399 m; 400-599 m; 600-799 m; and 800-1,000 m.) we were able to achieve a more precise breakdown for the investigation of distance and its relationship to other factors: we were able to examine, for example, the possibility that the age distribution of children tested differed significantly in any of these rings.

In fact, we found that although the children age groups appeared to have similar distributions in the rings (see Figure 5.6), statistically they were significantly different in all three areas. For example, at TRS the 0-4 age group had a significantly higher percentage tested in the first two rings than did the 5-9 and 10-14 age groups.

The adult age groups generally had similar age distributions with distance when considered as males and females separately; when considering adults of both sexes together, however, the age distribution with distance varied significantly at CM and Pr.

These results indicate that age and sex must be allowed for when analyzing the relationship between blood lead and distance.

Table 5.8 shows the results of the statistical analysis of age distributions within the distance rings upon which the above comments were based.

The numbers used in calculating these results may be found in *Appendix 5D.*

TABLE 5.8
SIGNIFICANCE OF CHI-SQUARE TEST ON AGE DISTRIBUTION WITHIN RINGS

Area	Children			Adults		
	Male	Female	Combined	Male	Female	Combined
Toronto Refiners	**	*	***	N.S.D.	N.S.D.	N.S.D.
Canada Metal	N.S.D.	**	**	N.S.D.	N.S.D.	*
Prestolite	*	N.S.D.	*	N.S.D.	*	**

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
N.S.D.—No significant difference

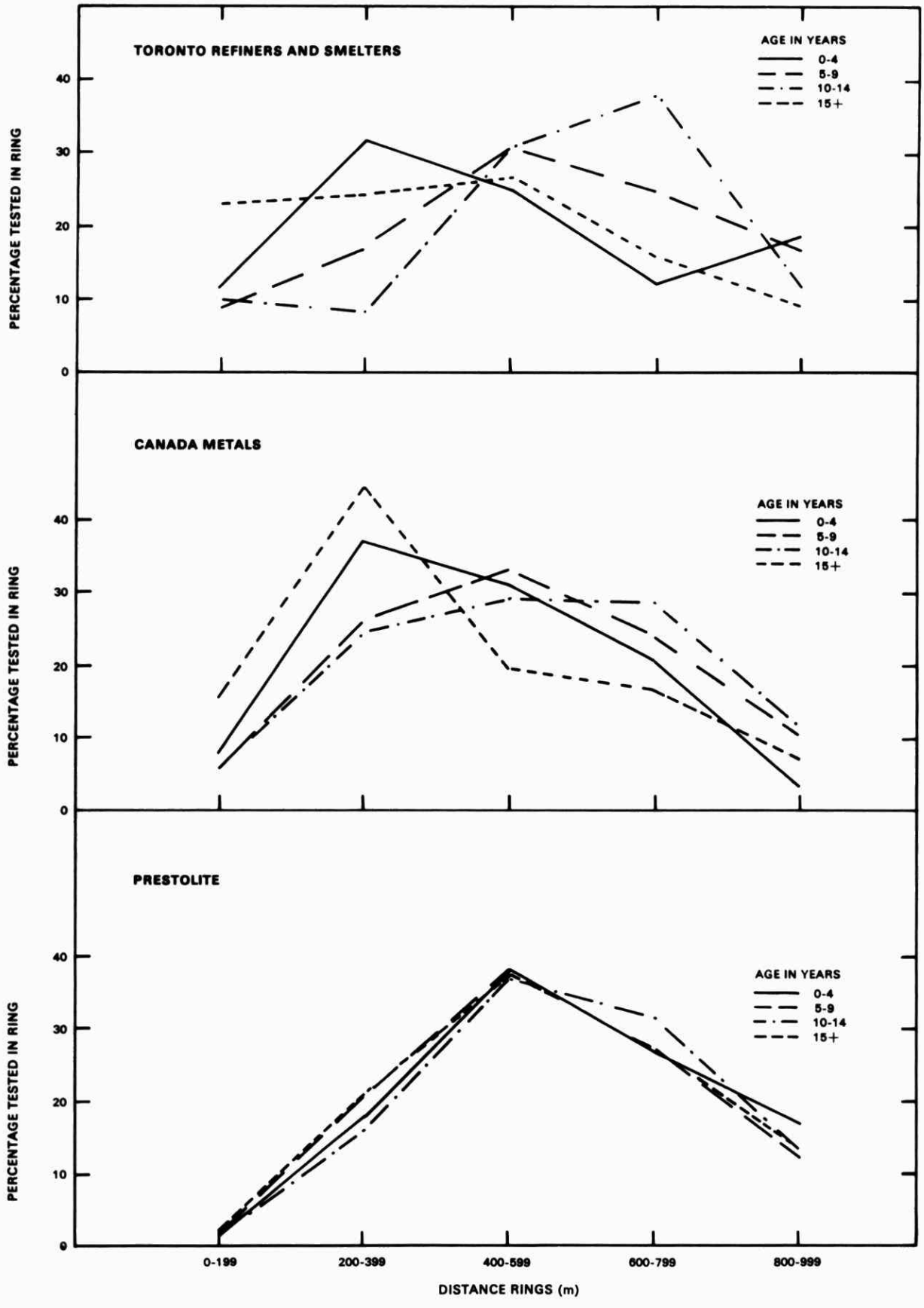


FIGURE 5.6 NUMBER OF PEOPLE TESTED IN THE DISTANCE RINGS AS A PERCENTAGE OF TOTAL PEOPLE TESTED VS. THE DISTANCE RINGS FOR THE AGE GROUPS.

CHAPTER 6

DESCRIPTION AND ANALYSIS OF BLOOD LEAD LEVELS

6.1 Distribution of Blood Lead Levels

In all, there were 7,092 people with valid first tests in the designated areas: 734 in the TRS area; 1,787 in the CM area; 3,589 in the Pr area, and 982 in the Control Area. The distribution of the results of these tests is given in Table 6.1.

When the blood lead levels were analyzed, two approaches were taken to the results: a 'discrete' division of results into two groups (highs and lows); and a 'continuous' approach using individual blood lead levels.

TABLE 6.1
DISTRIBUTION OF RESULTS OF BLOOD LEAD LEVEL TESTS

Blood Lead Level (mcg/100 ml.)	Area			
	Toronto Refiners	Canada Metal	Prestolite	Control Area
0-9.99	15	8	115	13
10.0-19.99	347	567	1,825	541
20.0-29.99	302	810	1,277	388
30.0-39.99	47	309	294	37
40.0-49.99	15	69	64	3
50.0-59.99	7	18	7	0
60.0-69.99	1	4	5	0
70.0-79.99	0	1	2	0
80.0-89.99	0	0	0	0
90.0-99.99	0	1	0	0

6.1.1 Discrete Distribution of High and Low Blood Lead Levels

Our definition of what constituted 'high' blood lead levels was a reading of 40 mcg or more per 100 ml of whole blood.

Among the 7,092 people with valid first tests 197 were highs—a figure which represents 2.8 per cent of the total—and we have very limited information on the follow-up of these people. As described in Chapter 2, these individuals were contacted immediately the high result became known, and urged to report to their own physician or to the Hospital for Sick Children for a confirmatory blood test, and follow-up or treatment if indicated. We were unable to determine how many actually had a second blood lead determination and in what proportion of these the second reading was also above 40 mcg per 100 ml. However, we do know that 24 children were admitted to the Hospital for Sick Children for investigation, and that with the exception of one with a re-test level of 49, all had re-test levels of at least 50 mcg per 100 ml.

The breakdown of the number of highs and lows by area is shown in Table 6.2.

The table also shows the 'borderline' cases (30-39 mcg/100 ml) as well as the percentage of highs (12.5%)

TABLE 6.2
SUMMARY OF 'HIGH' AND 'BORDERLINE' BLOOD LEAD LEVELS

Area	No. of Subjects	No. of People $\geqslant$40 mcg	No. of People 30-39 mcg	No. of People $<$30 mcg
Toronto Refiners	734	23 (3.1%)	47	70 (9.5%)
Canada Metal	1,787	93 (5.2%)	309	402 (22.5%)
Prestolite	3,589	78 (2.2%)	294	372 (10.4%)
Control Area	982	3 (0.3%)	37	40 (4.1%)
All Areas	7,092	197 (2.8%)	687	884 (12.5%)

we would have found had we used as a definition of a high blood lead level the 30 mcg and above figure as opposed to 40 mcg.

A further breakdown of the high group into adult/child groups by sex is shown in Table 6.3.

The children and adult groups for each area were compared to determine if there was a statistically significant difference in the percentage of highs. In Table 6.3 an asterisk beside the child group indicates a statistically significant difference between that group and the corresponding adult group.

TABLE 6.3
NUMBER OF PEOPLE WITH HIGH BLOOD LEAD LEVELS BY AGE AND SEX

Area	Children		Adults	
	Male	Female	Male	Female
Toronto Refiners	9 (4.6%)	3 (1.4%)	11 (7.1%)	0 (0%)
Canada Metal	43 (7.9%)	28 (5.1%)**	17 (6.4%)	5 (1.2%)
Prestolite	43 (3.3%)	22 (1.7%)**	12 (4.1%)	1 (0.2%)
Control	2 (0.5%)	0 (0%)	0 (0%)	1 (1.2%)
All Areas	97 (3.9%)	53 (2.1%)	40 (5.4%)	7 (0.5%)

**Significant at 1%

Only at CM and Pr, in the female group, was there a statistically significant difference between the children and adults. In these two areas the female children had a statistically significantly higher percentage over 40 mcg than did the corresponding adult female group.

Table 6.4 shows the significance levels for comparison of the percentage of highs between sexes for the children and adult groups.

Tables 6.3-6.4 shows that the male children at Pr had a statistically significantly higher percentage with elevated blood lead levels than did the corresponding female children group. For the other areas there was no statistically significant difference in percentage of highs between the male and female children groups.

TABLE 6.4
SIGNIFICANCE OF THE DIFFERENCE IN THE PERCENTAGE OF HIGHS BETWEEN SEXES

Area	Children	Adults
Toronto Refiners	N.S.D.	***
Canada Metal	N.S.D.	***
Prestolite	*	***
Control Area	N.S.D.	N.S.D.

*Significant at 5% level
***Significant at 0.1% level
N.S.D.—No significant difference

For the adults, there was a statistically significantly higher percentage of people with elevated blood lead levels for the males as compared with the females in all three plant areas, but this was not the case in the Control Area.

6.1.2 Continuous Distribution of Blood Lead Levels

Figure 6.1 shows the distribution of blood lead levels and the distribution of the natural logarithms (ln) of the blood lead levels within each of the areas. The distribution of the blood lead levels is skewed to the right, and logarithmic transformation can be used to normalize the distribution. In all further analyses the natural logarithm (ln) of the blood lead was used.

Geometric mean blood lead levels for each area are given in Table 6.5.

In Table 6.6 the geometric mean blood lead levels are further broken down by sex for the adult/child groups for the four areas.

As in the previous section the asterisks in the table mean that the given child groups are significantly different from their respective adult group. The table shows that female children have statistically significantly higher blood lead levels than do female adults for all four areas while only at Pr are the male children significantly different from male adults.

TABLE 6.5
GEOMETRIC MEAN BLOOD LEAD LEVELS (MCG/100 ML) FOR EACH AREA

Area	No. of Subjects	Geometric Mean (mcg/100 ml)	95% Confidence Interval for the Geometric Mean
Toronto Refiners	734	19.25	18.8-19.8
Canada Metal	1,787	22.90	22.5-23.3
Prestolite	3,589	18.76	18.5-19.0
Control Area	982	18.52	18.2-18.9

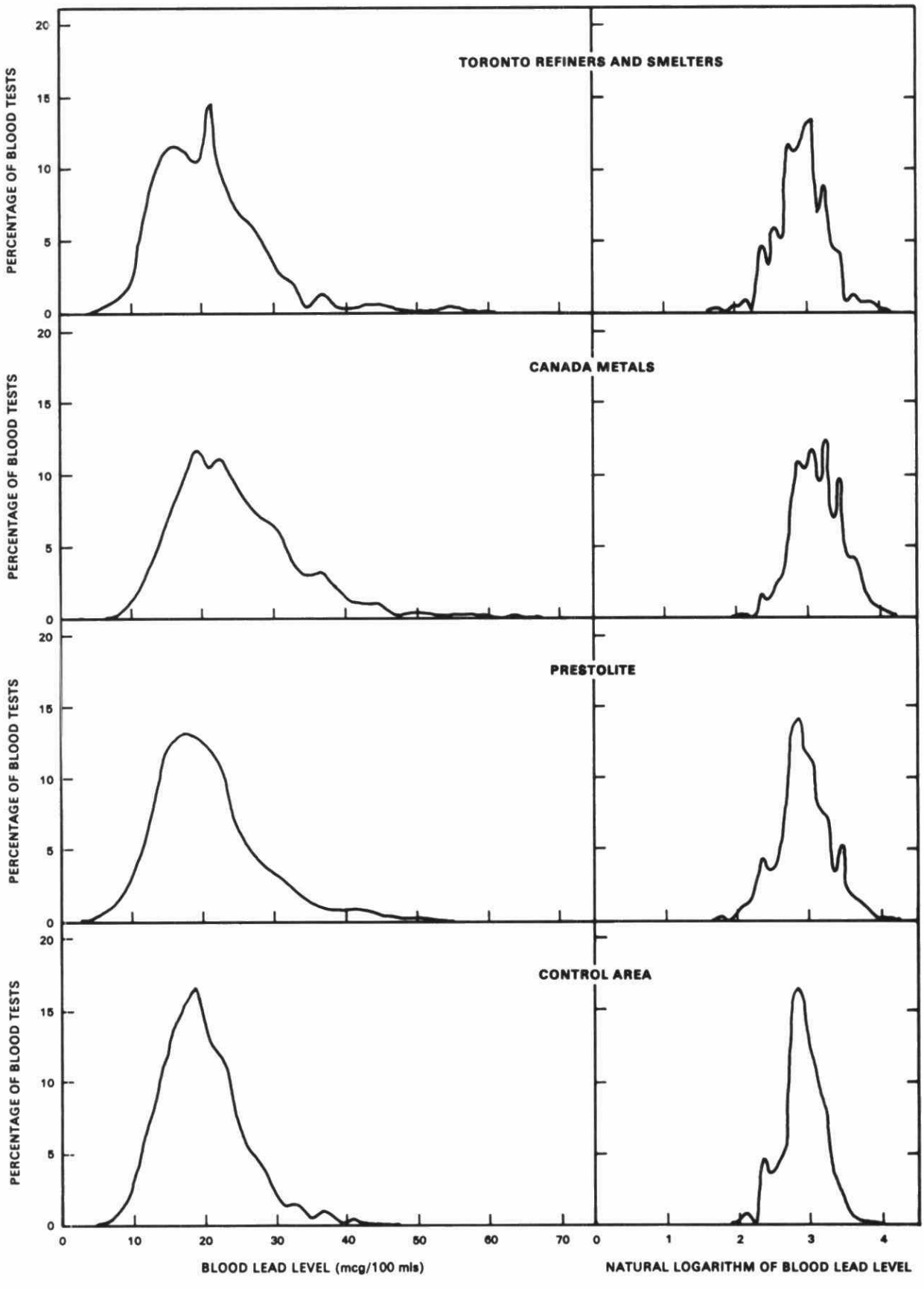


FIGURE 6.1 DISTRIBUTIONS OF BLOOD LEAD LEVELS AND THE NATURAL LOGARITHM OF THE BLOOD LEAD LEVELS.

Table 6.7 shows the significance levels for a comparison of male and female geometric mean blood lead levels for the children and adult groups.

As can be seen from Tables 6.6 and 6.7 the males—children and adults—had significantly higher mean blood lead levels than the females for all areas. The differences ranged from 1.4 to 7.2 mcg.

TABLE 6.6
GEOMETRIC MEAN BLOOD LEAD LEVELS (MCG/100 ML) BY SEX AND AGE GROUP

Area	Children		Adults	
	Male	Female	Male	Female
Toronto Refiners	21.5	18.9***	22.2	15.3
Canada Metal	25.0	22.6***	24.8	19.7
Prestolite	20.5***	18.5***	22.4	15.2
Control Area	19.5	18.1***	19.3	15.6

***Significant at 0.1% level

TABLE 6.7
SIGNIFICANCE OF THE DIFFERENCE IN THE GEOMETRIC MEANS BETWEEN SEXES

Area	Children	Adults
Toronto Refiners	***	***
Canada Metal	***	***
Prestolite	***	***
Control Area	***	**

**Significant at 1% level
***Significant at 0.1% level

6.2 Comparison of Blood Lead Levels by Age Group

6.2.1 Discrete Comparison

Table 6.8 gives a detailed breakdown of the percentage of highs into various age groups.

No statistical analysis has been performed on this table because of the small number of high cases in each cell.

6.2.2 Continuous Comparison

Tables 6.9 and 6.10 show the geometric means broken down by age group and sex for each area.

TABLE 6.8
NUMBER OF ELEVATED BLOOD LEAD LEVELS BY AGE GROUPS

Males

Area	Age						
	0-4	5-9	10-14	15-24	25-34	35-44	45+
Toronto Refiners	2 (6.1%)	6 (7.6%)	1 (1.2%)	2 (4.4%)	2 (5.9%)	1 (3.8%)	6 (12.2%)
Canada Metal	16 (18.8%)	17 (7.2%)	10 (4.5%)	4 (4.8%)	0 (0%)	4 (9.1%)	9 (8.6%)
Prestolite	11 (4.1%)	24 (3.6%)	8 (2.1%)	0 (0%)	5 (7.9%)	3 (3.1%)	4 (6.0%)
Control	1 (2.4%)	0 (0%)	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
All	30 (7.0%)	47 (3.8%)	20 (2.5%)	6 (2.8%)	7 (5.1%)	8 (4.6%)	19 (8.3%)

TABLE 6.8 (Cont'd.)
NUMBER OF ELEVATED BLOOD LEAD LEVELS BY AGE GROUPS

Females

Area	Age						
	0-4	5-9	10-14	15-24	25-34	35-44	45+
Toronto Refiners	1 (2.9%)	2 (2.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Canada Metal	13 (13.4%)	11 (4.7%)	4 (1.8%)	1 (0.8%)	2 (2.6%)	0 (0%)	2 (1.4%)
Prestolite	7 (2.6%)	10 (1.6%)	5 (1.2%)	0 (0%)	1 (0.5%)	0 (0%)	0 (0%)
Control	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (5.9%)	0 (0%)
All	21 (4.8%)	23 (1.9%)	9 (1.0%)	1 (0.3%)	3 (0.8%)	1 (0.3%)	2 (0.6%)

TABLE 6.9
GEOMETRIC MEAN BLOOD LEAD LEVELS (MCG/100 MLS) BY AGE GROUP

Males

Area	Age Groups						
	0-4	5-9	10-14	15-24	25-34	35-44	45+
Toronto Refiners	23.2	22.3	20.4	20.6	22.7	22.4	23.0
Canada Metal	27.4	25.7	23.5	23.2	25.2	26.1	25.7
Prestolite	21.8	20.9	18.8	18.4	24.0	23.7	23.1
Control	21.8	19.8	18.1	17.7	22.7	18.2	21.0

SIGNIFICANCE LEVELS DERIVED FROM ANALYSIS OF VARIANCE
COMPARISON OF GEOMETRIC MEAN BLOOD LEAD LEVELS FOR MALES

Children—Toronto Refiners

	0-4	5-9	10-14
0-4	—	N.S.D.	N.S.D.
5-9	—	—	N.S.D.
10-14	—	—	—

Children—Canada Metal

	0-4	5-9	10-14
0-4	—	N.S.D.	**
5-9	—	—	***
10-14	—	—	—

Children—Prestolite

	0-4	5-9	10-14
0-4	—	N.S.D.	***
5-9	—	—	***
10-14	—	—	—

Children—Control Area

	0-4	5-9	10-14
0-4	—	N.S.D.	***
5-9	—	—	**
10-14	—	—	—

Adults—Toronto Refiners

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	N.S.D.	N.S.D.
25-34	—	—	N.S.D.	N.S.D.
35-44	—	—	—	N.S.D.
45+	—	—	—	—

Adults—Canada Metal

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	*	*
25-34	—	—	N.S.D.	N.S.D.
35-44	—	—	—	N.S.D.
45+	—	—	—	—

Adults—Prestolite

	15-24	25-34	35-44	45+
15-24	—	***	***	***
25-34	—	—	N.S.D.	N.S.D.
35-44	—	—	—	N.S.D.
45+	—	—	—	—

Adults—Control Area

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	N.S.D.	N.S.D.
25-34	—	—	N.S.D.	N.S.D.
35-44	—	—	—	N.S.D.
45+	—	—	—	—

TABLE 6.10
GEOMETRIC MEAN BLOOD LEAD LEVELS (MCG/100 MLS) BY AGE GROUP

Females

Area	Age Groups						
	0-4	5-9	10-14	15-24	25-34	35-44	45+
Toronto Refiners	23.4	19.8	17.0	14.4	15.0	16.3	16.1
Canada Metal	25.9	23.6	20.5	18.0	18.8	20.0	21.3
Prestolite	20.2	19.0	16.7	14.7	15.0	14.9	16.8
Control	19.7	19.0	16.5	14.0	15.6	18.8	15.2

SIGNIFICANCE LEVELS OF COMPARISON OF AGE GROUPS

Children—Toronto Refiners

	0-4	5-9	10-14
0-4	—	*	***
5-9	—	—	***
10-14	—	—	—

Children—Canada Metal

	0-4	5-9	10-14
0-4	—	*	***
5-9	—	—	***
10-14	—	—	—

Children—Prestolite

	0-4	5-9	10-14
0-4	—	**	***
5-9	—	—	***
10-14	—	—	—

Children—Control Area

	0-4	5-9	10-14
0-4	—	N.S.D.	***
5-9	—	—	***
10-14	—	—	—

Adults—Toronto Refiners

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	N.S.D.	N.S.D.
25-34	—	—	N.S.D.	N.S.D.
35-44	—	—	—	N.S.D.
45+	—	—	—	—

Adults—Canada Metal

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	*	***
25-34	—	—	N.S.D.	*
35-44	—	—	—	N.S.D.
45+	—	—	—	—

Adults—Prestolite

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	N.S.D.	**
25-34	—	—	N.S.D.	**
35-44	—	—	—	***
45+	—	—	—	—

Adults—Control Area

	15-24	25-34	35-44	45+
15-24	—	N.S.D.	*	N.S.D.
25-34	—	—	N.S.D.	N.S.D.
35-44	—	—	—	N.S.D.
45+	—	—	—	—

Generally, for children of both sexes, the youngest age group has statistically significantly higher mean blood lead levels than does the eldest child group. Male children at TRS do not follow the pattern established in the other areas. For adults the mean blood levels seem on the whole to be age group independent for both sexes at TRS and CA. At CM and Pr the age group 15-24 for both sexes has a significantly lower mean blood lead level than do the more elderly adult groups.

It should be remembered that any differences in average blood lead level between age groups may be due to the differences in the distribution of each age group with distance from the plants (see Chapter 5).

6.3 Comparison of Blood Lead Levels by Distance Rings

While distance from a lead source is not in itself a causal factor when it come to the matter of lead pathways, other environmental factors (such as airborne lead and dustfall) are known to decrease as distance from their source increases. Some relationship between blood lead levels and distance might be expected around known sources of lead.

6.3.1 Definition of Distance (Centroid and Boundary)

In calculating distance there were several options: measurements could be taken from the centroid of the plant area, from the main stack or emission point, from the plant boundary—or from a combination of all of these.

The Task Force decided, since various sources of lead had been found within the plant areas, to take co-ordinates both of the centroid and the boundary.

Centroid, by dictionary definition, is 'the point in an area common to all lines whose moment of area is zero'—in other words, the geometric centre.

For each individual the distance from both the centroid and the nearest plant boundary was calculated. Some analyses were performed using both distances and the results did not alter the conclusion to be drawn from these analyses; hence, only the distance from the centroid was used in subsequent analyses.

6.3.2 Discrete Comparison of Blood Lead Levels and Distance Rings

To examine the possibility of there being some relationship between high blood lead levels and distance from the lead plants we calculated the percentage of highs for a series of concentric 200-metre distance rings about the centroid.

Table 6.11 shows the number of highs in each of the distance rings for each area separately, and Figure 6.2 presents the number of highs as a percentage of the people tested in each distance ring.

For TRS and CM the percentage of highs is significantly greater (at the 0.1% level) in the ring nearest the plants than in the farthest ring; for Pr there is no statistical difference as distance increases.

TABLE 6.11
NUMBER OF ELEVATED BLOOD LEAD LEVELS BY DISTANCE RINGS

Distance Rings (m)	Area		
	Toronto Refiners	Canada Metal	Prestolite
0-199	16 (14%)	17 (10%)	1 (2%)
200-399	1 (1%)	43 (7%)	20 (3%)
400-599	4 (2%)	21 (4%)	34 (3%)
600-799	2 (1%)	9 (2%)	11 (1%)
800-999	0 (0%)	3 (2%)	12 (2%)
All	23 (3%)	93 (5%)	78 (2%)

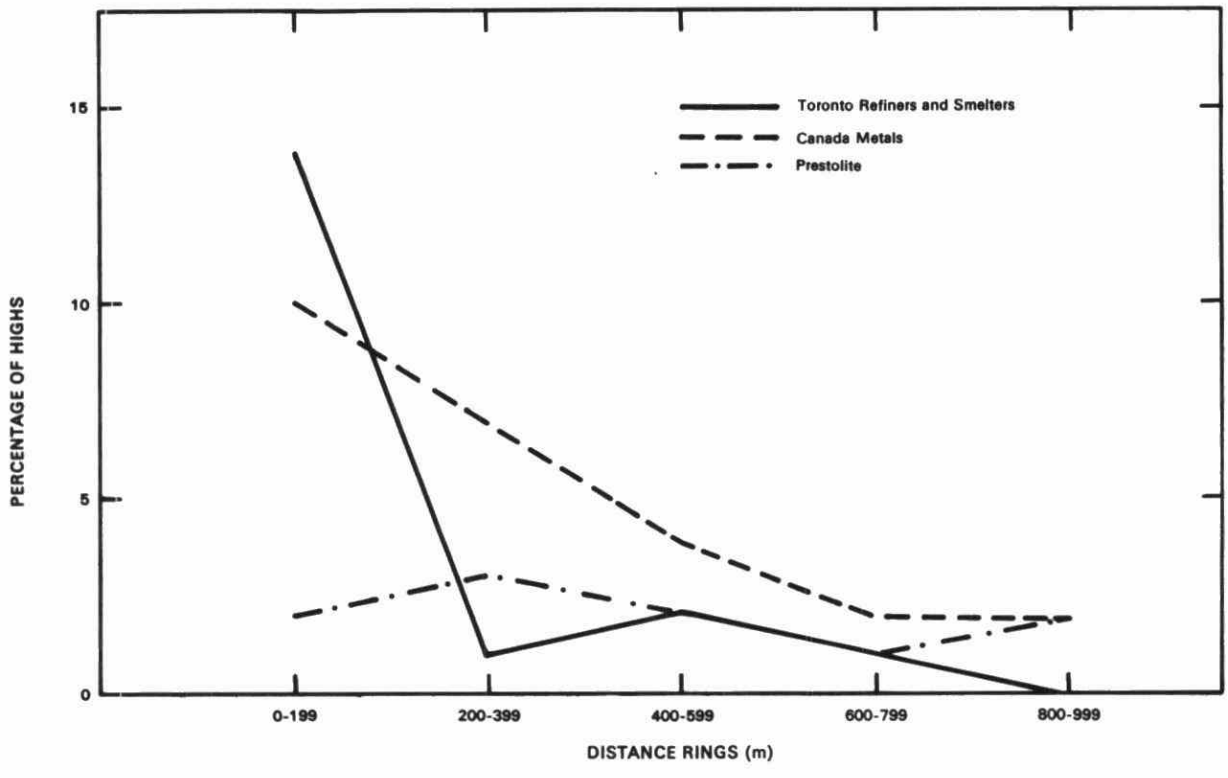


FIGURE 6.2 NUMBER OF PEOPLE WITH HIGH BLOOD LEAD LEVELS AS A PERCENTAGE OF TOTAL PEOPLE TESTED VS. THE DISTANCE RINGS.

6.3.3 Continuous Comparison of Blood Lead Levels and Distance Rings

Table 6.12 shows the geometric mean blood lead levels for 200-metre concentric rings from the plant centroids broken down in the adult/child groups by sex.

As can be seen from Table 6.12, for children of both sexes in all three areas there is generally a statistically significant decline in mean blood lead level between the innermost (0-199 m.) and more distant rings. For the adult groups a similar trend is evident only for males at CM.

TABLE 6.12
GEOMETRIC MEAN BLOOD LEAD LEVELS (MCG/100 MLS) BY DISTANCE RINGS

Ring	Toronto Refiners				Canada Metal				Prestolite			
	Children		Adults		Children		Adults		Children		Adults	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-199	32.7	23.4	24.1	16.5	29.6	25.0	27.6	20.8	25.4	23.7	32.1	15.5
200-399	20.1 (***)	16.8 (***)	20.5 (*)	13.3 (**)	27.6 (NSD)	25.2 (NSD)	25.0 (*)	20.7 (NSD)	21.5 (*)	19.8 (*)	21.9 (NSD)	15.8 (NSD)
400-599	21.5 (***)	17.9 (***)	21.6 (NSD)	15.3 (NSD)	24.3 (***)	22.6 (NSD)	23.7 (*)	19.4 (NSD)	20.3 (**)	18.1 (***)	22.6 (NSD)	15.1 (NSD)
600-799	20.7 (***)	18.4 (**)	22.2 (NSD)	16.0 (NSD)	22.9 (***)	20.8 (**)	24.0 (*)	16.9 (***)	19.5 (***)	18.1 (***)	21.5 (NSD)	15.3 (NSD)
800-999	20.7 (***)	20.2 (NSD)	25.7 (NSD)	16.6 (NSD)	23.0 (***)	20.8 (*)	21.9 (**)	18.3 (NSD)	20.8 (*)	17.9 (***)	24.6 (NSD)	14.9 (NSD)

NOTE: Significance levels in brackets under the Geometric Mean refer to comparison of the mean of that ring to the innermost (0-199 m.) ring.
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

6.4 Multiple Regression Analysis

In the previous sections of this chapter we have examined blood lead levels in a number of ways as they relate to age, sex, and distance individually. Keeping the sexes separate, distance and age should be considered simultaneously when examining their relationship to blood lead levels and that is the purpose of this section. Using multiple regression analysis, including these three factors, allows us to determine the effect of age and distance on blood lead levels individually while compensating for the effect of the other. Seasonality was also considered as another possible variable to include in the multiple regression analysis, but proved to be unimportant *(see Appendix 6A)*.

6.4.1 Distance Regression

Age was included in the analysis in two ways. Adults and children were considered separately because of anticipated behavioral differences, possible differences in absorption, metabolism and excretion, and possible adult occupational exposure. So regressions were performed on the child and adult populations separately. The regression included, within each of the adult and child subgroups, distance and age (by single years) as the independent variables. The groups were further divided by sex. This has the effect of reducing any age or sex bias that might affect the distance regression.

In all the analysis results shown and discussed in this chapter, the figures relate to distance from the plant centroids. Results using the nearest boundary as the source were virtually identical to those in which the centroid was used; in fact, in no case was the significance of regressions altered by taking the boundary as the starting point for calculating distance.

Since the Working Group on Lead had shown in its report that dustfall and air lead decrease virtually to 'normal' or 'background' levels within 350 metres of the lead plants, we performed regression analysis on the relationship between blood lead level and distance for the ranges $<$350 m. and 350-1000 m.—to see whether, if a gradient was found, it was more pronounced closer to the plant.

All the regressions in this section use the natural logarithm (ln) of blood lead in the analyses but the results shown in the text have been converted for easier interpretation.

Table 6.13 summarizes the significance of the regression coefficients for distance for the various areas and distance groupings. The coefficients can be found in *Appendix 6B*. The coefficients for age, and their significance, will be discussed in the next section.

TABLE 6.13
SIGNIFICANCE OF THE DISTANCE REGRESSION COEFFICIENT IN THE EQUATION LN (BLOOD LEAD) VS. DISTANCE AND AGE

Distance[1] (⩽1,000 m.)

Area	Children			Adults		
	Males	Females	Combined	Males	Females	Combined
Toronto Refiners	−**	−NSD	−*	−NSD	+NSD	−NSD
Canada Metal	−***	−***	−***	−**	−***	−***
Prestolite	−**	−***	−***	+NSD	−NSD	−NSD
Control	−NSD	+NSD	+NSD	+NSD	−NSD	−NSD
Canada Metal & Control	−***	−***	−***	−***	−***	−***

Distance[1] (<350 m.)

Area	Children			Adults		
	Males	Females	Combined	Males	Females	Combined
Toronto Refiners	−***	−**	−***	−*	−*	−**
Canada Metal	−NSD	−NSD	−NSD	−*	+NSD	−NSD
Prestolite	−NSD	−NSD	−*	−NSD	+NSD	+NSD
Control	−NSD	+NSD	−NSD	−NSD	+NSD	+NSD

Distance[1] (350-1,000 m.)

Area	Children			Adults		
	Males	Females	Combined	Males	Females	Combined
Toronto Refiners	−NSD	+NSD	+NSD	+NSD	+NSD	−NSD
Canada Metal	−NSD	−NSD	−*	−NSD	−**	−**
Prestolite	−NSD	−NSD	−*	+NSD	−NSD	−*
Control	+NSD	+NSD	+NSD	−**	−NSD	−NSD

[1]Distance is measured from the centroid
(−)Negative regression coefficient
(+)Positive regression coefficient
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

Table 6.14 shows the change in average blood lead level for given distance ranges, ages and sex for regressions which proved to be statistically significant in the preceding analysis. These results were obtained by evaluating the regression equations which use the natural logarithm of the blood lead levels, and include age as an independent variable. Hence the equations must be solved for specific ages.

1. *Toronto Refiners and Smelters.* Looking at the whole area, i.e. ⩽1,000 m., the regressions are significant only for male children and the combined children groups.

In the area close to the plant (i.e. <350 m.) we found a highly significant negative regression of blood lead levels with distance for the children, and a moderately significant negative regression for adults of both sexes. The negative regression means that the average blood lead level decreases as distance from the plant increases. For example, the decline in average blood lead level for male children age 12, from 75 to 350 m. from the plant is 27.7 mcg.

In areas farther from the plant (350-1,000 m.) there was no significant regression for any of the subgroups.

These results indicate that there is a relationship between blood lead levels and distance from the plant as shown in the <350 m. range and the ⩽1,000 m. range.

2. *Canada Metal.* In the entire (⩽1,000 m.) area there is a strong negative regression for the total population as well as for all the subgroups.

In the area close the the CM plant, that is <350 m., the only statistically significant regression between blood lead level and distance was found among adult males, and shows a decrease of blood lead with distance.

In the area farthest from the plant, i.e. 350-1,000 m., the combined (male and female) children group, as well as the adult females, were all statistically significant in their negative regression.

One possible explanation for the lack of a significant regression close to the plant is that the scatter of blood lead levels found closer to the plant is so great as to obscure any possible relationship between close proximity and elevated blood lead levels. But in the area as a whole, i.e. ⩽1,000 m., there is a pronounced decline in blood lead levels between the nearer and the more distant areas. For example, the average blood lead level of a seven year old female declines by 7.6 mcg between 100 and 1,000 m. from the plant centroid.

3. *Prestolite.* In the entire (⩽1,000 m.) area there is a statistically strong negative regression for both of the children groups: the average blood lead level of a 12 year old male, for example, declines by 2.4 mcg between 150 and 1,000 m. from the plant centroid.

In the area close to the Prestolite plant (<350 m.) there is a negative relationship between blood lead levels and distance for both the combined adult and combined children groups; farther from the plant a relationship holds true only for the combined children group.

Here again, it is possible that the scatter of readings close to the plant obscures any clear relationship in that area. There does seem, though, to be a general decline—at least for the children—between blood lead levels found closer to the plant and those found farther away from it.

4. *Control Area.* For the Control Area, distance is calculated from the 'centroid' a point near the intersection of Dundas and Broadview Streets.

The only significant relationship found between blood lead levels and distance in this area was for male adults living within 350-1,000 m. of the 'centroid'.

TABLE 6.14
AVERAGE CHANGES IN BLOOD LEAD LEVELS (MCG/100 MLS)
OVER GIVEN DISTANCE RANGES
(Shown for Regressions Significant at 5% Level)

Toronto Refiners and Smelters

Sex	Age (yr.)	Distance Range		
		75[1]-350 m.	350-1000 m.	75[1]-1000 m.
Male	2	-36.49	—	-5.28
	7	-31.80	—	-5.06
	12	-27.71	—	-4.84
	35	- 9.06	—	—
Female	2	-20.12	—	—
	7	-16.52	—	—
	12	-13.56	—	—
	35	- 9.43	—	—

Canada Metal

Sex	Age (yr.)	Distance Range		
		100[1]-350 m.	350-1000 m.	100[1]-1000 m.
Male	2	—	—	-8.84
	7	—	—	-8.16
	12	—	—	-7.52
	35	- 5.39	—	-5.14
Female	2	—	—	-8.78
	7	—	—	-7.56
	12	—	—	-6.51
	35	—	-1.77	-5.06

Prestolite

Sex	Age (yr.)	Distance Range		
		150[1]-350 m.	350-1000 m.	150[1]-1000 m.
Male	2	—	—	-2.85
	7	—	—	-2.62
	12	—	—	-2.41
	35	—	—	—
Female	2	—	—	-3.39
	7	—	—	-3.01
	12	—	—	-2.67
	35	—	—	—

[1]Distance from centroid to nearest residence.

6.4.2 Age Regression

The following results were obtained from the regression analysis described in chapter 6.3 and a summary of the results appears in Table 6.15 with the coefficients themselves to be found in *Appendix 6B.*

The ages used in the analysis are exact to the nearest year.

Examples of some of the changes in average blood lead level (for given distances from the plant and given sex) which result from changes in age appear in Table 6.16. These results and the subsequent discussion are based on the results obtained using people from the entire ($\leqslant$1,000 m.) area.

1. *Toronto Refiners and Smelters.* In this area there is a statistically significant decrease in blood lead levels with age for the female and combined children groups, but not for the male children. There is a statistically significant increase in blood lead levels with increasing age only for the combined adult group.

2. *Canada Metal.* In the CM area there is a strong negative relationship for children of both sexes, but a significant positive one for the female adult and the combined adult groups.

It appears, then, that for this plant area too, blood lead levels decrease with increasing age in children and show a contrasting increase with age in adults.

3. *Prestolite.* In the area as a whole there is a statistically strong negative regression with age for children, but for adults of both sexes there is a statistically significant positive regression with age.

4. *Control Area.* In all three distance groups the negative relationship between blood lead levels and age among the children found in all three plant areas applies in the Control Area, too. There is no significant relationship between blood lead level and age for any of the adult groups.

In summary, the predominant theme in the relationship between blood lead levels and age seems to be that those levels decrease with age in children but increase with age in adults. For instance, the decline in mean blood for male children living close to CM is 2.5 mcg from the age of two to the age of seven.

TABLE 6.15
SIGNIFICANCE OF THE AGE REGRESSION COEFFICIENT IN THE EQUATION LN (BLOOD LEAD) VS. DISTANCE AND AGE

Age (At Distances ⩽1,000 m.)

Area	Children			Adults		
	Males	Females	Combined	Males	Females	Combined
Toronto Refiners	–NSD	–***	–***	+NSD	+NSD	+*
Canada Metal	–***	–***	–***	+NSD	+***	+***
Prestolite	–***	–***	–***	+**	+*	+***
Control	–***	–***	–***	+NSD	+NSD	+NSD
Canada Metal & Control	–***	–***	–***	+NSD	+***	+***

Age (At Distances <350 m.)

Area	Children			Adults		
	Males	Females	Combined	Males	Females	Combined
Toronto Refiners	–*	–**	–***	+NSD	+*	+*
Canada Metal	–**	–***	–***	+NSD	+NSD	+NSD
Prestolite	–NSD	–NSD	–NSD	+NSD	+NSD	+NSD
Control	–**	–***	–***	+NSD	+NSD	+NSD

Age (At Distances 350-1,000 m.)

Area	Children			Adults		
	Males	Females	Combined	Males	Females	Combined
Toronto Refiners	–NSD	–***	–***	+NSD	+NSD	+NSD
Canada Metal	–*	–***	–***	+NSD	+***	+***
Prestolite	–***	–***	–***	+**	+*	+**
Control	–**	–***	–***	+NSD	+NSD	+NSD

(–)Negative regression coefficient
(+)Positive regression coefficient
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

TABLE 6.16
AVERAGE CHANGE IN BLOOD LEAD LEVEL (MCG/100 MLS) FOR VARIOUS CHANGES IN AGE
(Shown for Regressions Significant at 5% Level)

Toronto Refiners and Smelters

Sex	Distance	Age Change			
		2-7	7-12	20-35	35-50
M	75[1]	—	—	—	—
	1000	—	—	—	—
F	75[1]	–4.18	–3.47	—	—
	1000	–4.03	–3.34	—	—

Canada Metal

Sex	Distance	Age Change			
		2-7	7-12	20-35	35-50
M	100[1]	–2.48	–2.31	—	—
	1000	–1.80	–1.67	—	—
F	100[1]	–4.39	–3.78	+1.14	+1.20
	1000	–3.17	–2.73	+0.87	+0.91

Prestolite

Sex	Distance	Age Change			
		2-7	7-12	20-35	35-50
M	150[1]	–1.92	–1.77	+1.39	+1.48
	1000	–1.69	–1.56	+1.39	+1.48
F	150[1]	–2.57	–2.28	+0.65	+0.67
	1000	–2.19	–1.94	+0.59	+0.63

Control Area

Sex	Distance	Age Change			
		2-7	7-12	20-35	35-50
M	100	–2.11	–1.91	+1.32	+1.42
	1000	–2.06	–1.86	+1.42	+1.52
F	100	–3.15	–2.69	—	—
	1000	–3.38	–2.89	—	—

[1]Distance from plant centroid to nearest residence.

6.5 Comparison of Mean Blood Lead Levels Between Plant Areas and Control Area

In the preceding sections of this chapter we have examined the relationship of the blood lead levels to age, sex, and distance from the lead plants for each area. In this section, we will examine the blood lead levels for the three lead plant areas as compared to the Control Area.

From the figures in Table 6.2 it is evident that the percentage of people with elevated blood leads in the Control Area (0.3%) is significantly lower than in the three plant areas.

When comparing the means between the plant areas and the Control Area the distributions of the study populations by sex and age must be allowed for, because of possible differences in distribution of these variables between the areas (see chapter 5). Again, the plant areas were divided into the two distance groups (<350 m. and 350-1,000 m.). Table 6.17 summarizes the results of the comparison of each plant area to the Control Area for the given age and sex group.

6.5.1 Comparison for Children

We have shown in previous sections that the study populations of children do not have the same age distribution in the plant areas as in the Control Area, and that blood lead level varies with age for the children; consequently, the children must here be subdivided into age groups to minimize the effects of these differences in distribution between the plant areas and the Control Area.

Table 6.17 shows that in the TRS area the male children in the two eldest age groups have blood lead levels statistically significantly higher than those in the Control Area regardless of the distance group used. This finding does not generally hold true for the youngest male group (0-4 yrs.) or for any of the female age groups in any of the distance groups.

In the CM area as a whole, the mean blood lead levels for all the age groups of both sexes are statistically significantly higher than in the corresponding age and sex groups in the Control Area. This holds true for all age and sex groups in closer proximity to the plant (<350 m.) as well as for all age and sex groups more remote from the plant except for the youngest male group.

In the Pr area no clear trend is evident for the children groups of either sex when the area as a whole (⩽1,000 m.) and the area farther (350-1,000 m.) from the plant are considered; however, closer to the plant (<350 m.) there is a significant difference between the geometric means of all age and sex groups and the corresponding Control Area groups except for the 0-4 year age group for both sexes.

6.5.2 Comparison for Adults

As discussed in Chapter 5 there was no statistical difference in the age distribution of the adult population when comparing TRS and CM with the Control Area. In the Pr area, there was a statistically significant difference in the age distribution, but it is small and would have little effect on this analysis; hence, in this analysis the adult age groups have been pooled.

Among the males, blood lead levels are significantly higher within 1,000 m. of the plants than in the Control Area. This holds true for the <350 m. distance from all plants, and for the 350-1,000 m. distance range for all except TRS. For the male groups within 350 m. of the plants, blood lead levels ranged from 3 mcg to 7 mcg higher than those in the Control Area.

In the CM area the females had significantly higher blood lead levels in all three distance groupings. Close to the CM plant, blood lead levels were more than 5 mcg higher on average than in the Control Area; in the TRS and Pr areas the mean blood lead levels of females were not significantly different on average than in the Control Area.

6.6 Analysis of Blood Lead Levels and Estimated Soil Lead Levels

6.6.1 Estimation of Soil Lead Levels

Since there were approximately 8,000 blood tests and a very limited number of houses sampled by the City of Toronto for soil, we used a technique in which data from systematic surveys of each area conducted by the Ministry of the Environment's Phytotoxicology Section were used to estimate a topsoil lead value for each house.

The survey data used included those collected in June, 1974 at TRS and CM; in July, 1974 at Pr, and October, 1974 in the Control Area *(see Appendix 6C for a list of raw data).*

The estimation method used the SYMAP program described in Chapter 4. This technique interpolates on a rectangular grid pattern from the neighboring measured data points. The grid was selected so that the level of resolution provided one calculated point on the grid for each house.

As a by-product of the estimating procedure, contour maps can be drawn through points having equal soil lead levels and these appear on the following pages.

TABLE 6.17
GEOMETRIC MEAN BLOOD LEAD LEVELS (MCG/100 ML) FOR EACH AREA BY AGE GROUP AND SEX AND ANALYSIS OF VARIANCE COMPARISON BETWEEN THE PLANT AREAS AND THE CONTROL AREA

Distance Range (≤1,000 m.)

Age Group	Sex	Area			
		Toronto Refiners	Canada Metal	Prestolite	Control
0-4	Male	23.2 (NSD)	27.4 (***)	21.8 (NSD)	21.8
5-9		22.3 (**)	25.7 (***)	20.9 (*)	19.8
10-14		20.4 (**)	23.5 (***)	18.8 (NSD)	18.1
15+		22.1 (*)	24.9 (***)	22.3 (*)	19.3
0-4	Female	23.4 (*)	25.9 (***)	20.2 (NSD)	19.7
5-9		19.8 (NSD)	23.6 (***)	19.0 (NSD)	19.0
10-14		17.0 (NSD)	20.5 (***)	16.7 (NSD)	16.5
15+		15.3 (NSD)	19.6 (***)	15.2 (NSD)	15.6

Distance Range (<350 m.)

Age Group	Sex	Area			
		Toronto Refiners	Canada Metal	Prestolite	Control
0-4	Male	25.0 (NSD)	31.9 (***)	21.5 (NSD)	21.8
5-9		23.1 (*)	30.8 (***)	22.4 (***)	19.8
10-14		22.3 (*)	25.1 (***)	20.5 (*)	18.1
15+		22.4 (*)	26.0 (***)	22.9 (*)	19.3
0-4	Female	22.9 (NSD)	32.1 (***)	20.1 (NSD)	19.7
5-9		20.3 (NSD)	27.0 (***)	20.8 (**)	19.0
10-14		19.0 (NSD)	22.5 (***)	19.3 (***)	16.5
15+		14.7 (NSD)	20.8 (***)	15.6 (NSD)	15.6

Distance Range (350-1,000 m.)

Age Group	Sex	Area			
		Toronto Refiners	Canada Metal	Prestolite	Control
0-4	Male	21.7 (NSD)	24.0 (NSD)	21.9 (NSD)	21.8
5-9		22.0 (*)	24.1 (***)	20.6 (NSD)	19.8
10-14		20.2 (*)	23.1 (***)	18.6 (NSD)	18.1
15+		21.9 (NSD)	23.7 (**)	22.2 (*)	19.3
0-4	Female	23.8 (*)	23.5 (**)	20.2 (NSD)	19.7
5-9		19.7 (NSD)	22.6 (***)	18.7 (NSD)	19.0
10-14		16.6 (NSD)	19.9 (***)	16.2 (NSD)	16.5
15+		15.8 (NSD)	18.7 (***)	15.2 (NSD)	15.6

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

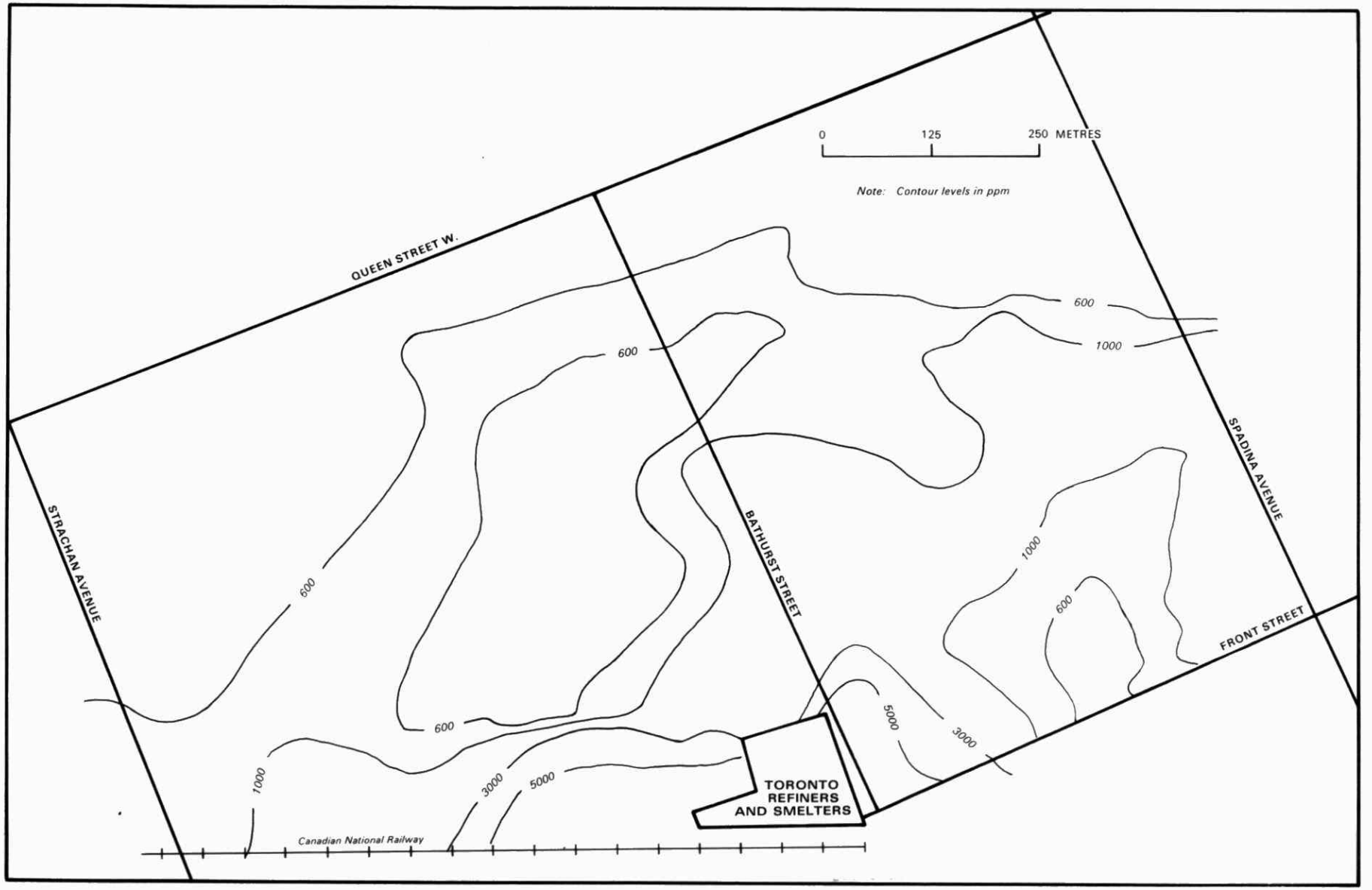


FIGURE 6.3 CONTOUR MAP OF SOIL LEAD LEVELS FOR THE TORONTO REFINERS AND SMELTERS AREA

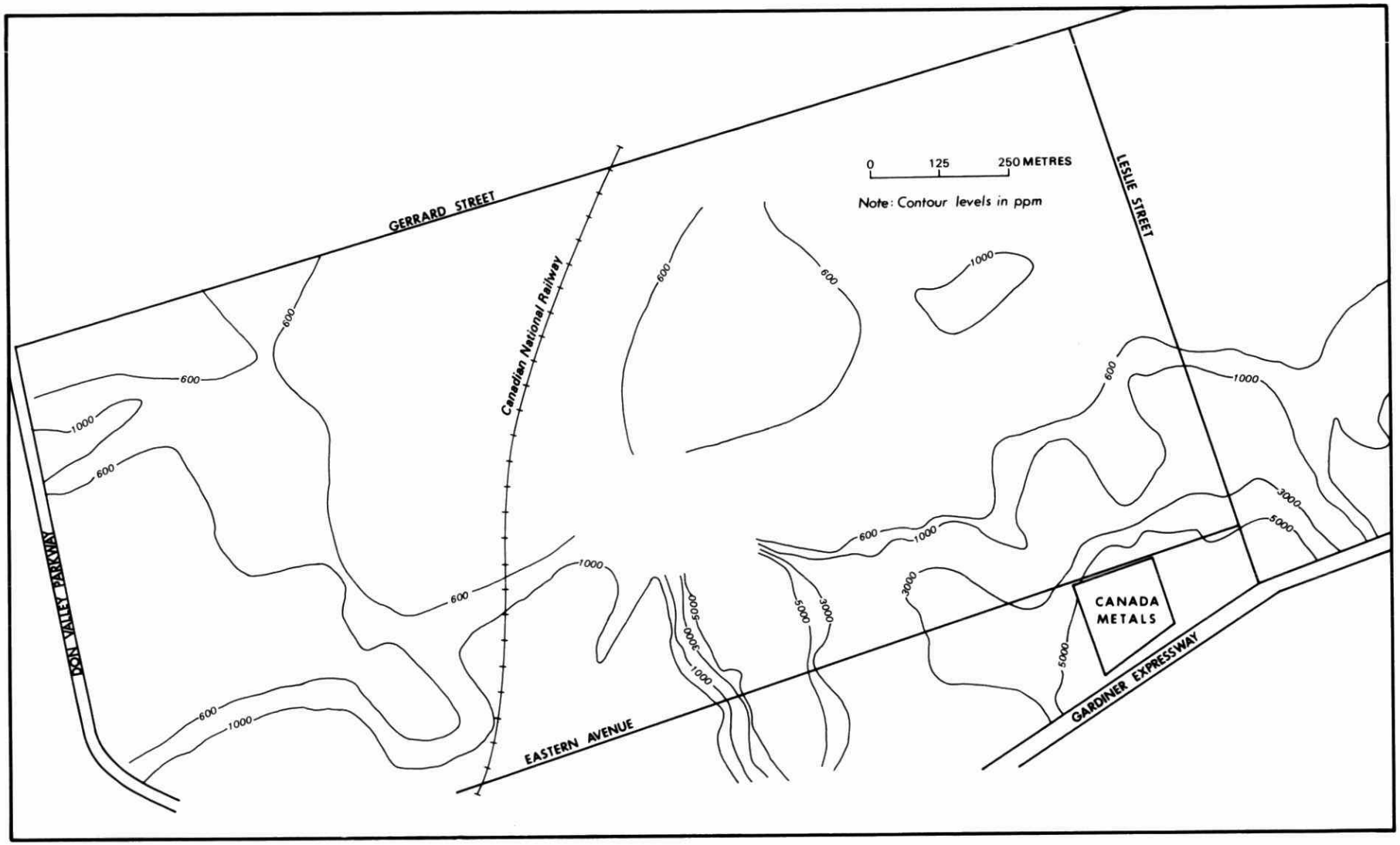


FIGURE 6.4 CONTOUR MAP OF SOIL LEAD LEVELS FOR THE CANADA METAL AREA AND THE CONTROL AREA

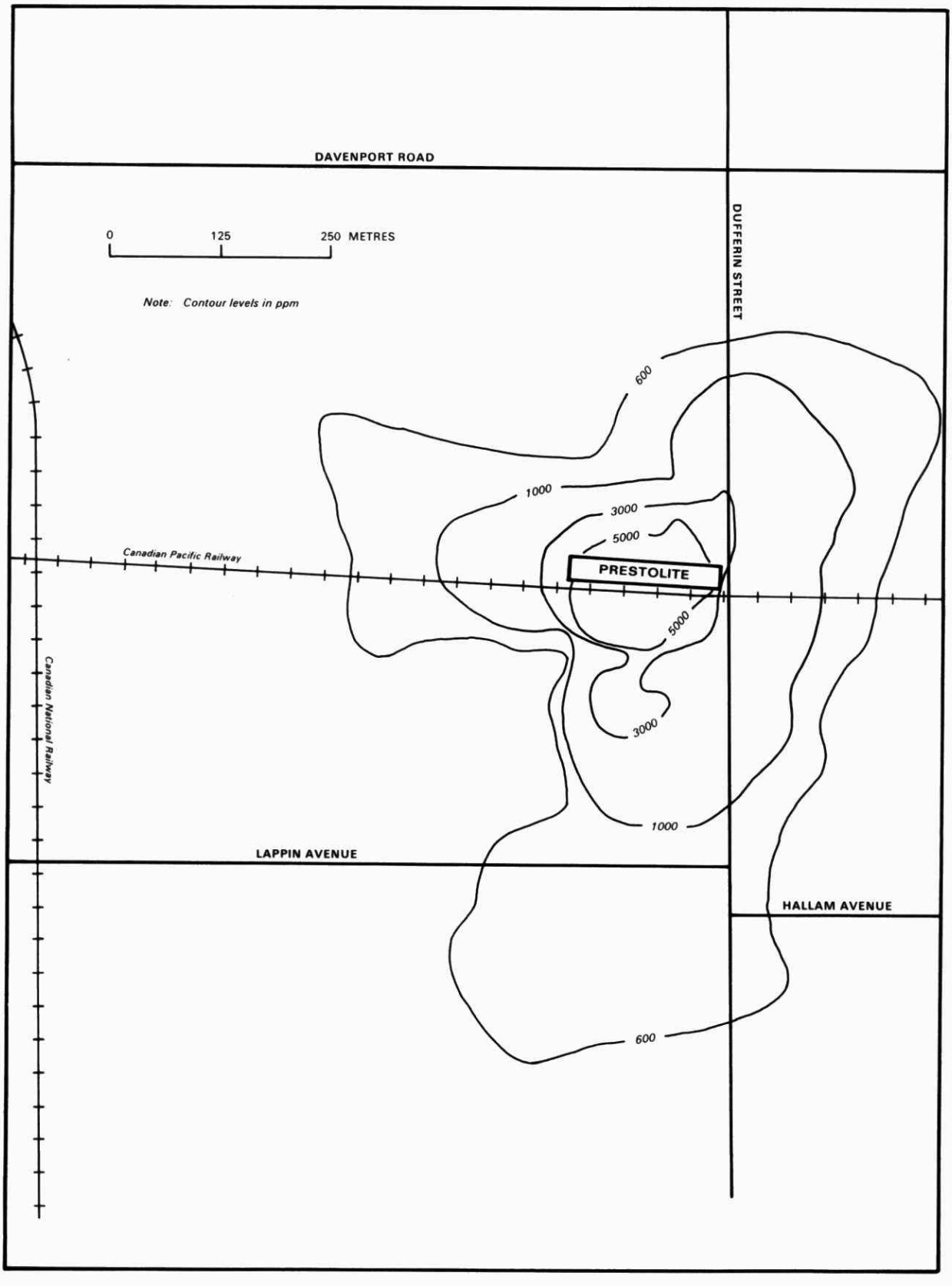


FIGURE 6.5 CONTOUR MAP OF SOIL LEAD LEVELS FOR THE PRESTOLITE AREA

The estimation procedure was accomplished as follows: the soil lead data were put into the SYMAP program; the interpolated values and their co-ordinates for each point on the grid were put onto a magnetic tape; the co-ordinates for each person's house were then matched to the closest set of co-ordinates on the grid, and their interpolated value was added to the computer file record for that person.

It should be noted that the analyses in this section and the following section are based only on people living within 500 metres of the plant centroids since the soil lead survey by the Phytotoxicology Branch did not extend much beyond this distance; thus the estimation technique breaks down beyond the 500 metre distance.

6.6.2 Comparison of City of Toronto Soil Results and Estimated Soil Results

It is of interest to compare the estimated soil lead levels attributed to those few houses for which actual soil samples were collected by the City of Toronto in its survey *(see Appendix 6D)*. A close relationship between the estimated soil leads and the City of Toronto's samples cannot be expected since they were collected for different purposes and by different people using different techniques. For example, the phytotoxicology soil samples were collected at increasing distances along several radii from each source and the collection sites were either on private property or in schools, parks and vacant lands. The City of Toronto samples, however, did come only from private property. In spite of these considerations the agreement between means is remarkably good.

Table 6.18 shows the geometric means and 95 per cent confidence intervals for the means for the estimated soil samples and the City of Toronto soil samples.

6.6.3 Distribution of Blood Lead Levels by Estimated Soil Lead Level

In order to assess the effect of soil lead levels on blood lead levels, analyses similar to those carried out for distance were used. Persons were assigned to five soil lead level ranges based upon the soil lead level estimated for their property. The five ranges were 0-599 ppm, 600-999 ppm, 1,000-2,999 ppm, 3,000-4,999 ppm, and 5,000 ppm and over. The blood lead levels of people assigned to each of these ranges were then analyzed using the 'discrete' and 'continuous' methods as outlined previously.

In the 'discrete' method the number of high and low blood lead levels were counted for each soil lead level range, and Table 6.19 summarizes these results.

TABLE 6.18
COMPARISON OF THE GEOMETRIC MEANS OF THE EST. PHYTO SOIL SAMPLES AND THE CITY OF TORONTO SOIL SAMPLES

Area	Number of Cases	Soil Est. Phyto		City Samples	
		Mean (ppm)	95% Confidence Interval for the Mean	Mean (ppm)	95% Confidence Interval for the Mean
Toronto Refiners	9	1178	953-1456	1104	386-3154
Canada Metal	61	1179	896-1550	798	662-961
Prestolite	25	503	431-586	565	431-742

As can be seen from Table 6.19, when the results are considered by sex and age group the number of cases is too small to make a chi-square test valid, so no significance levels are given in the table. As an aid to visualizing these results Figure 6.6 shows the percentage of highs in each soil lead level range plotted against the range; it shows the percentage of highs only for the case when all three plant areas were combined.

The graph shows that the percentage of people with elevated blood lead levels increases as the soil lead level rises. This is particularly true for children of both sexes.

In the 'continuous' method the people were assigned to the soil lead level ranges as above, but the geometric mean blood lead level was then calculated for each range. The results of this analysis are shown in Table 6.20. The table also shows the significance levels for the analysis of variance comparison of the geometric mean blood lead level in the lowest soil lead level range (0-599 ppm) with the mean blood lead level in each of the other soil lead level ranges.

When the three plant areas are pooled there is a statistically significant rise in geometric mean blood lead level as the soil lead level increases for both sexes in the adult and child groups.

When all areas are considered separately it is evident that the male children who live in houses where the soil lead level is over 1,000 ppm have statistically significantly higher mean blood lead levels than do male children in houses where the soil lead level is less than 600 ppm. For the CM area this trend is also significant for female children and male adults. A similar trend is shown in some of the other subgroups but is not statistically significant.

TABLE 6.19
NUMBER OF HIGH AND LOW BLOOD LEAD LEVELS BY SOIL LEAD LEVEL RANGES

Soil Lead Level Range (ppm)	Blood Lead Level (mcg)	Toronto Refiners				Canada Metal				Prestolite				Three Plant Areas Combined			
		Children		Adults		Children		Adults		Children		Adults		Children		Adults	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-599	⩾40	0	0	1	0	5	0	1	1	12	8	6	0	17	8	8	1
	<40	19	20	37	36	100	88	32	70	248	239	73	128	367	347	142	234
600-999	⩾40	0	0	4	0	7	4	2	2	11	3	1	0	18	7	7	2
	<40	34	34	29	35	51	53	48	71	136	168	32	76	221	255	109	182
1000-2999	⩾40	7	3	4	0	11	7	6	0	0	1	0	0	18	11	10	0
	<40	13	22	33	31	71	79	70	102	25	18	2	11	109	119	105	144
3000-4999	⩾40	0	0	0	0	4	5	5	1	0	0	0	0	4	5	5	1
	<40	0	3	2	1	28	28	20	30	0	0	0	0	28	31	22	31
5000+	⩾40	0	0	0	0	6	3	2	0	0	0	0	0	6	3	2	0
	<40	0	0	0	0	13	2	7	9	0	2	0	1	13	4	7	10

TABLE 6.20
SUMMARY OF GEOMETRIC MEAN BLOOD LEAD LEVELS
CLASSIFIED BY ESTIMATED SOIL LEAD LEVELS

Soil Lead Level Range (ppm)	Toronto Refiners				Canada Metal				Prestolite				All Three Plant Areas			
	Children		Adults		Children		Adults		Children		Adults		Children		Adults	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-599	22.4	19.6	20.6	14.9	23.6	22.0	22.9	20.1	21.2	19.8	23.0	16.2	21.9	20.3	22.4	17.1
600-999	20.0 (NSD)	18.1 (NSD)	22.5 (NSD)	13.4 (NSD)	27.0 (*)	23.7 (NSD)	24.6 (NSD)	20.9 (NSD)	22.1 (NSD)	18.8 (NSD)	22.1 (NSD)	14.7 (NSD)	22.9 (NSD)	19.7 (NSD)	23.3 (NSD)	16.6 (NSD)
1000-2999	29.2 (*)	21.4 (NSD)	23.3 (NSD)	17.1 (NSD)	26.8 (**)	25.2 (**)	24.6 (NSD)	20.4 (NSD)	24.4 (*)	23.3 (NSD)	36.4 (NSD)	16.2 (NSD)	26.7 (***)	24.1 (***)	24.4 (*)	19.3 (***)
3000-4999	—	19.6 (NSD)	20.5 (NSD)	11.0 (—)	30.2 (***)	29.8 (***)	30.0 (***)	22.5 (NSD)	—	—	—	—	30.2 (***)	28.8 (***)	29.1 (***)	22.0 (***)
5000+	—	—	—	—	36.4 (***)	36.6 (***)	33.1 (***)	21.4 (NSD)	—	22.9 (NSD)	—	23.0 (—)	36.4 (***)	32.0 (***)	33.1 (***)	21.6 (*)

NOTE: The significance levels in brackets under the mean are for the comparison of that mean with the mean for the range 0-599 ppm.

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

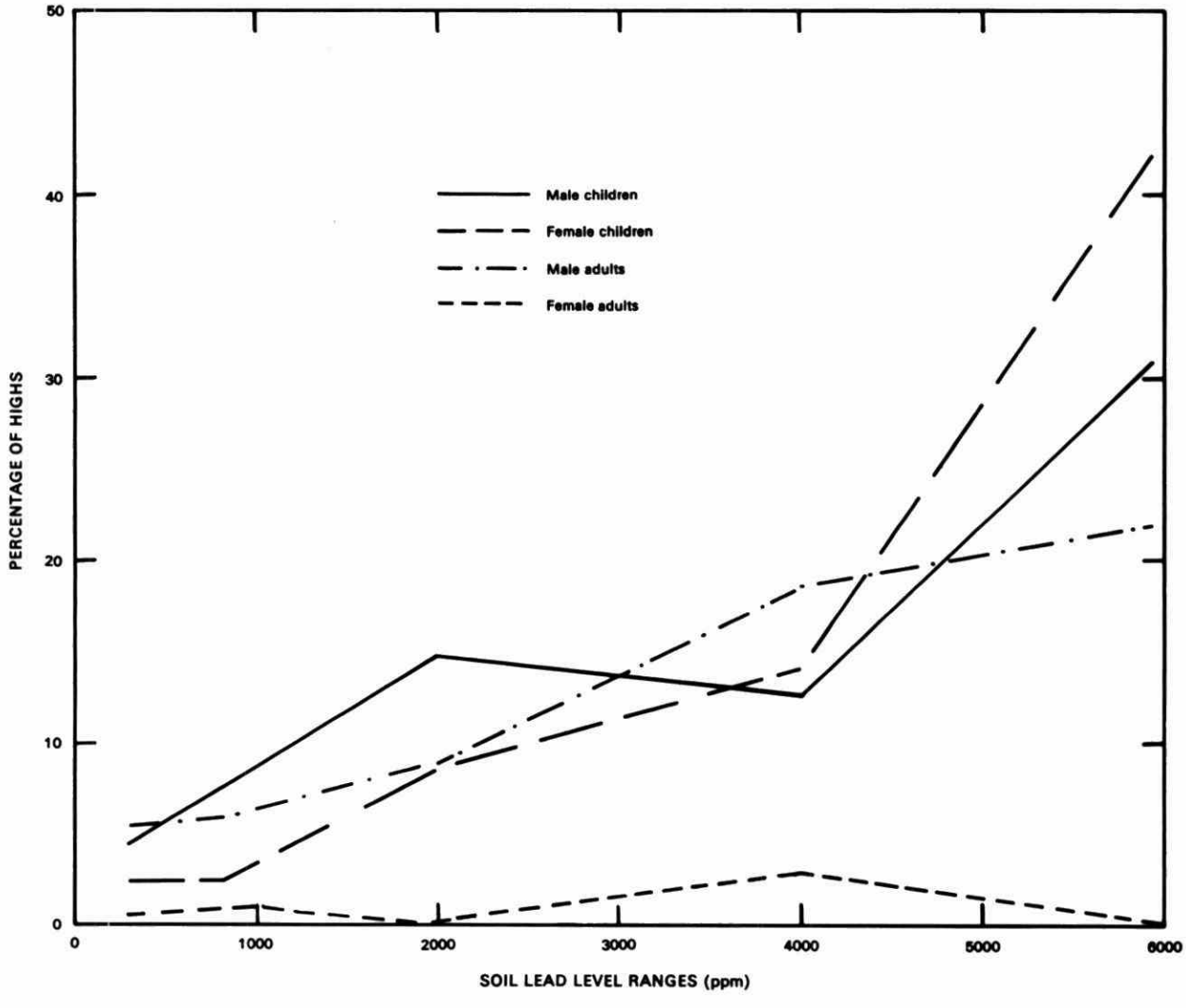


FIGURE 6.6 NUMBER OF PEOPLE WITH HIGH BLOOD LEAD LEVELS AS A PERCENTAGE OF THE TOTAL PEOPLE TESTED IN AREAS WITH ESTIMATED SOIL LEAD LEVELS IN THE RANGES 0-599, 600-999, 1000-2999, 3000-4999, 5000+ P. P. M. (THREE PLANT AREAS COMBINED)

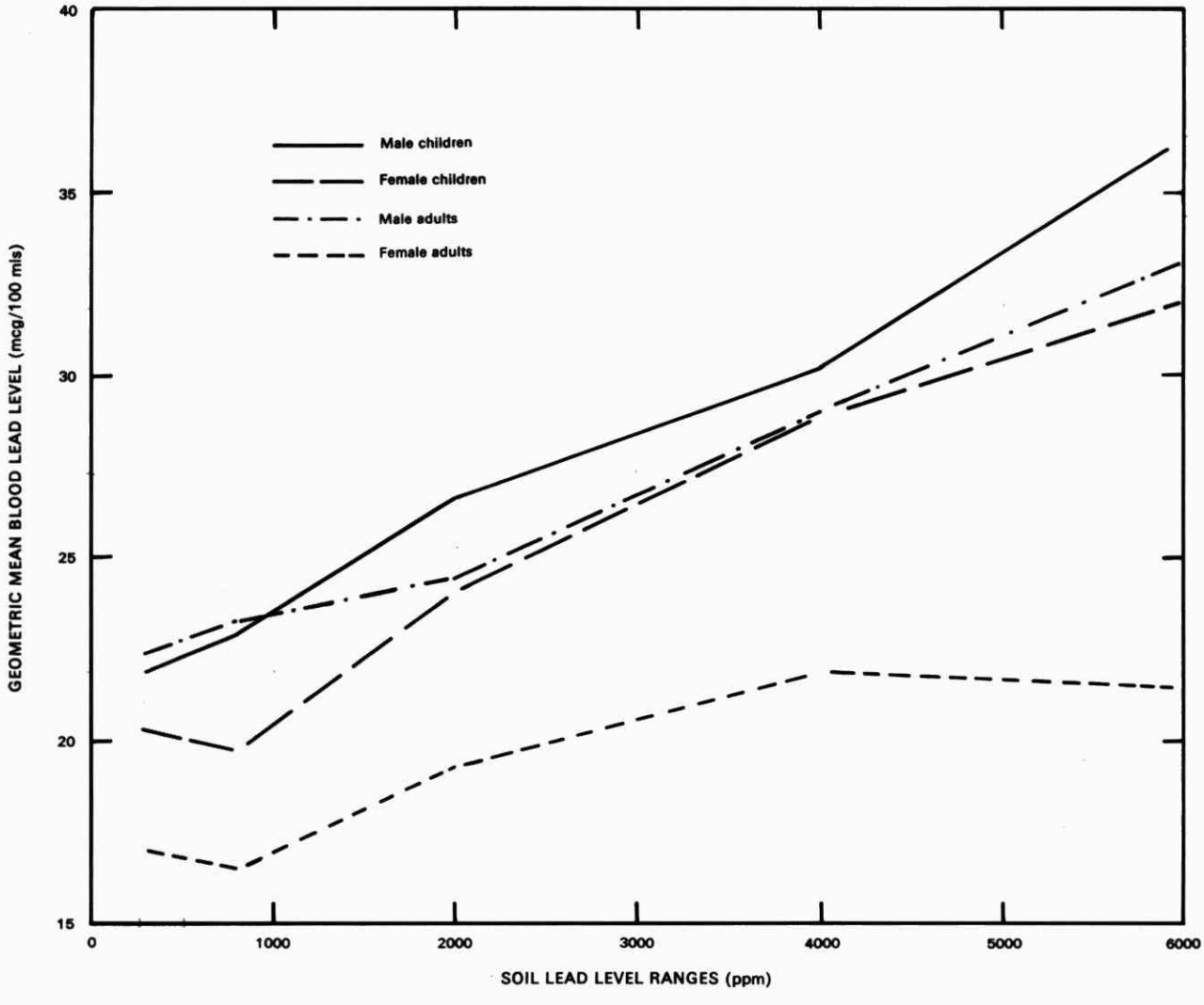


FIGURE 6.7 GEOMETRIC MEAN BLOOD LEAD LEVEL OF PEOPLE RESIDENT IN AREAS WITH ESTIMATED SOIL LEAD LEVELS IN THE RANGES 0-599, 600-999, 1000-2999, 3000-4999, 5000+ P.P.M. (THREE PLANT AREAS COMBINED)

6.6.4 Regression Analysis of Blood Lead Levels and Estimated Soil Lead Levels

As before, in performing regressions on blood lead levels, age and sex must be taken into account as confounding variables; consequently, the regressions of blood lead levels versus estimated soil lead levels include age (to the nearest year) as a co-variable and were done separately for the adult and child groups and for males and females within those groups. Results of these regressions are summarized in Table 6.21 and the coefficients are given in *Appendix 6E.*

Results indicate a statistically significant positive relationship between blood lead levels and estimated soil lead levels for the male children in all three plant areas, and also for the female children at CM.

For the adults, only the blood lead levels of males in the CM area showed a statistically significant relationship with estimated soil lead level but it should be noted that in all cases the regression coefficients are positive.

TABLE 6.21
SIGNIFICANCE OF SOIL LEAD REGRESSION COEFFICIENTS IN THE EQUATION LN (BLOOD LEAD LEVEL) VS. ESTIMATED SOIL LEAD LEVEL AND AGE

Area	Children			Adults		
	Male	Female	Combined	Male	Female	Combined
Toronto Refiners	+***	+NSD	+**	+NSD	+NSD	+NSD
Canada Metal	+***	+***	+***	+***	+NSD	+***
Prestolite	+**	+NSD	+*	+NSD	+NSD	+NSD

(—)Negative regression coefficient
(+)Positive regression coefficient
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

6.7 Lead in Dustfall

To determine the relative importance of historic soil lead contamination as compared to current lead in dustfall emissions from the plants in causing elevated blood lead levels, the relationship of blood lead levels to lead in dustfall should be analyzed in the same way that the relationship with soil lead levels has been. Unfortunately, too few dustfall samples were available to perform these analyses.

Lead in dustfall results can also be compared with the soil lead levels to examine the possibility that the pattern of current emissions (dustfall) from the plants is related to the pattern of historical contamination (soil lead).

Dustfall samples were collected at a small number of stations (see Working Group Report, 1974) by the Air Quality Section of the Ministry of the Environment. The Task Force has utilized the data from those stations where there were at least seven months of data available in 1973 and for which there was a Phytotoxicology Section soil lead sampling station within 50 metres.

The average lead content of the dustfall for 1973 was calculated for each station. The average soil lead levels, for soil samples taken within 50 m. of the dustfall sampling stations during 1973 were also calculated. The average dustfall and soil lead levels are shown in Table 6.22. Also shown are the correlation coefficients between lead in dustfall and topsoil (0-5 cm.) lead levels as well as subsoil (5-10 cm.) lead levels.

The significant correlation between lead in dustfall and lead in soil is compatible with the belief that current dustfall is contributing to the lead contamination of soil.

TABLE 6.22
AVERAGE LEAD LEVELS OF DUSTFALL AND SOIL SAMPLES

Station	Area	Dustfall (tons/mi²/month)	Soil (ppm)	
			Topsoil (0-5 cm)	Subsoil (5-10 cm)
31019	Canada Metal	0.49	3035	2840
31059	Canada Metal	0.56	2809	2767
31060	Canada Metal	0.16	663	368
31061	Canada Metal	0.09	650	713
31050	Toronto Refiners	1.19	12500	7127
31051	Toronto Refiners	0.41	5111	4189
31054	Toronto Refiners	0.14	454	439
	Correlation Coefficients		0.95 (***)	0.95 (***)

***Significant at 0.1% level

CHAPTER 7

RESULTS OF EPIDEMIOLOGICAL QUESTIONNAIRE AND SAMPLING PROGRAM

7.1 Description of Epidemiological Study Group

In the context of this report, 'epidemiological' is used in a limited sense referring only to those aspects of the study involving participants for whom at least a valid blood lead and an epidemiological Part Two (household) questionnaire are available. The formal criteria for inclusion in the 'epidemiological' study group were:

1. A valid first blood test taken between March 1, 1973 and November 30, 1974.
2. An 'epidemiological' Part Two (household) survey on their residence.

Table 7.1 summarizes the epidemiological study group breaking it down by blood lead level into high, low and borderline categories for each area. The Table also shows the number of people who underwent epidemiological Part One surveys, and subdivides these into the same three categories for each area. Finally, it shows the number of houses surveyed in the epidemiological Part Two (household) sampling program broken down into 'high' (H), 'match' (M), and 'control' (C) groups.

A 'high' house is defined as one in which there was at least one person with a blood lead level of 40 mcg (or more) per 100 ml of whole blood.

A 'match' house was selected for its proximity and similarity to a high house, and was one in which no person tested had a high blood lead level.

'Control' houses were selected 'randomly' in the Control Area from among those where blood tests had been done on some or all residents and no blood lead levels were elevated (see Chapter Two).

As Table 7.1 shows, not every person who had a blood test also had a Part One questionnaire. This was because some people were unavailable for interview when the nurses called at the home, because some refused to co-operate in the study or because occupants had moved before the interviews were conducted.

The number of match houses was not the same as the number of high houses partly because the people selected as matches had moved and a new family had moved into the house; in other cases, it was because no suitable match house could be found close to the high one or because co-operation was refused at the initially chosen match house.

TABLE 7.1
SUMMARY OF 'EPIDEMIOLOGICAL' STUDY GROUP

Area	Number of People with Blood Test By Blood Lead Level Groups			Number of Part One Questionnaires By Blood Lead Level Groups			Number of Part Two Questionnaires		
	⩾40	30-39 (mcg/100 mls)	<30	⩾40	30-39 (mcg/100 mls)	<30	H	M	C
Toronto Refiners	18	10	66	16	7	50	11	7	—
Canada Metal	87	96	276	84	70	215	74	70	—
Prestolite	64	52	226	60	39	159	60	55	—
Control	3	11	286	3	7	252	3	3	133
All	172	169	854	163	123	676	148	135	133

7.2 Part One Questionnaire (Personal)

As described in Chapter 2 the epidemiological Part One questionnaire was administered by the public health nurses on a sequence of forms that were improved as the sampling program evolved; an example of the finally-developed form is shown in Figure 7.1. *Examples of the earlier forms appear in Appendix 2F.*

Guidelines were issued to the nurses to aid them in completing the form *(see Appendix 7A).*

A summary of the number of responses to the questions appears in Table 7.2 for each area.

CITY OF TORONTO

DEPARTMENT OF PUBLIC HEALTH

EPIDEMIOLOGICAL DATA – LEAD QUESTIONNAIRE PART 1

1. IDENTIFICATION NO.

2. SURNAME

3. GIVEN NAME

4. APT. NO.

5. STREET NO.

6. MOD

7. STREET CODE

8. STREET NAME

9. SEX ☐ MALE ☐ FEMALE

10. BIRTHDATE D M Y

11. YR. OF IMMIG.

12. BIRTHPLACE

13. CODE

14. PRIMARY OCCUPATION TITLE

15. CODE

16. SCHOOL

17. GRADE

18. SECONDARY OCCUPATION TITLE

19. CODE

20. TELEPHONE No.

21. DATE OF HOME VISIT D M Y

22. PREVIOUS OCCUPATIONAL LEAD EXPOSURE ☐ Y IF YES EXPLAIN ON REVERSE ☐ N ☐ UNCERTAIN

NAME OF INTERVIEWER

23. LENGTH OF RESIDENCE AT PRESENT ADDRESS YRS MTHS

24. LENGTH OF RESIDENCE IN THIS TEST AREA YRS MTHS

25. LENGTH OF RESIDENCE IN OTHER TEST AREAS (LAST 5 YEARS) YRS MTHS

26. ADDRESSES FOR PAST 5 YRS OTHER THAN ABOVE

27. DAILY HRS SPENT AT RESIDENCE HRS

28. DAILY HOURS SPENT WORKING OR AT SCHOOL IN TEST AREA HRS

29. TOTAL LONG ABSENCES LAST 5 YEARS YRS MTHS

30. IS THERE A LEAD WORKER IN HOUSE ☐ Y ☐ N

31. IF YES NAME OF COMPANY

32. OCCUPATION TITLE

33. CODE

34. IS HE/SHE TESTED AT WORK REGULARLY ☐ Y ☐ N

35. IF Y, BLOOD OR URINE ☐ B ☐ U

36. DOES HE/SHE USE PROTECTIVE CLOTHING AT WORK ☐ Y ☐ N

37. ARE WORK CLOTHES CHANGED AT WORK ☐ Y ☐ N

38. ARE WORK CLOTHES WASHED WITH FAMILY CLOTHING ☐ Y ☐ N

39. ARE SHOWERS USED AT WORK ☐ Y ☐ N

40. IS AN ELECTRIC KETTLE USED BY THIS PERSON ☐ Y ☐ N

IF YES

41. HOW MANY CUPS A DAY DOES THIS PERSON DRINK

42. HOW MANY CUPS A DAY ARE USED IN COOKING

43. IS THERE A HISTORY OF ANEMIA ☐ Y ☐ N

44. IS GASOLINE SNIFFING ADMITTED ☐ Y ☐ N

45. CHILD KNOWN TO INGEST PAINT ☐ Y ☐ N

46. CHILD KNOWN TO INGEST SOIL ☐ Y ☐ N

47. OBSERVED SIGNS OF PAINT PICA ☐ Y ☐ N

48. HOW LONG HAS PERSON BEEN SMOKING YRS

USUAL TYPE OF SMOKING

49. CIGARETTE ☐ 1

50. NO. OF PACKS A DAY

51. OTHER ☐ 2

52. STATE TYPE AND QUANTITY

53. HAS PERSON STOPPED SMOKING IN PAST 5 YEARS ☐ Y ☐ N

54. IF Y, HOW LONG AGO YRS MTHS

55. DO OTHERS IN THE HOUSE SMOKE ☐ Y ☐ N

37-175

TABLE 7.2
NUMBER OF RESPONSES TO PART ONE QUESTIONNAIRE

Questions	Toronto Refiners	Canada Metal	Prestolite	Control Area
Sex	73	369	258	262
Birth Date	73	369	258	262
Year of Immigration	31	44	105	48
Birth Place Code	60	188	216	75
Occupation Code	71	351	248	262
Grade in School	2	51	71	228
Secondary Occupation Code	1	3	2	4
Previous Occupational Lead Exposure	73	116	207	250
Length of Residence this House	72	363	258	262
Length of Residence in this Plant Area	72	363	258	262
Length of Residence other Plant Area	3	4	5	8
Number of Hours per Day at Residence	72	345	241	262
No. of Hours Working or at School in Area	29	253	155	251
Long Absences in Last Five Years	3	40	54	11
Is there a Lead Worker in the House	73	369	257	255
Occupation Title Code	12	130	63	85
Tested at Work	0	2	4	83
Blood or Urine Test	0	0	0	0
Protective Clothes Worn	10	11	16	81
Change Clothes at Work	10	11	22	82
Are Clothes Washed with Family Wash	10	18	17	83
Shower at Work	10	16	16	82
Is an Electric Kettle Used	0	21	17	253
How Many Cups per Day Drunk	0	0	0	7
How Many Cups per Day in Cooking	0	0	0	2
History of Anaemia	0	13	18	248
Is Gasoline Sniffing Admitted	0	218	253	260
Is Person Known to Ingest Paint	0	10	17	230
Is Person Known to Ingest Soil	0	11	17	230
Is there Evidence of Paint Pica	0	10	19	232
How Long Smoking	0	14	2	7
Cigarettes	0	0	0	0
Number of Packs per Day	0	37	18	9
Other Smoking Materials	0	0	0	0
Has Person Stopped Smoking in Last 5 Yrs.	0	1	3	9
If Yes, How Long Ago	0	1	1	4
Do others in House Smoke	0	141	189	256
Total Number of Questionnaires:	73	369	258	262

7.3 Epidemiological Survey Part Two Questionnaire (Household)

As described in Chapter 2, the Part Two surveys was performed by public health inspectors from the City of Toronto Department of Public Health, again using improvements of a basic questionnaire the finalized version of which appears in Figure 7.2. *Examples of the earlier questionnaire are in Appendix 7B.*

The survey was in two parts: the questionnaire described in this section of the report, and the sample collection process (see Chapter 7.4).

Public health inspectors were given a guide for completing the forms *(see Appendix 7C)*. Documentation for the Part Two survey refers to it as the 'environmental survey'.

Table 7.3 summarizes the responses. Again, as we discussed in relation to the Part One survey, certain questions were not asked until quite late in the sampling program with the result that there were few responses to these questions.

7.4 Epidemiological Survey Part Two—Household Sampling

The public health inspectors collected samples from potential sources of lead in the home. There were 15 sample types: paint, dust (short-term), dust (long-term), wallpaper, plaster, soil (0-5 cm. depth), soil (5-10 cm. depth), water (cold, 0 mins.), water (cold, 10 mins.), water (hot, 0 mins.), water (hot, 10 mins.), ceramics, kettle water, wine, pickling liquid. All of these were collected from a wide variety of locations (47).

The number and type of samples for each house were left to the inspectors' discretion and they recorded extensive information about the sample locations and types *(see Appendix 7C)*. Tables 7.4-7.7 show the number of samples of each type collected at each location in the four areas.

CITY OF TORONTO

DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL DATA – LEAD QUESTIONNAIRE PART 2

1. APT No.
2. STREET No.
3. MOD
4. STREET CODE
5. STREET NAME
6. TELEPHONE No.
7. DATE OF INSPECTION (D M Y)
8. INSPECTOR

9. IS THERE A LEAD WORKER IN HOUSE ☐ Y ☐ N
10. IF Y, NAME OF COMPANY
11. OCCUPATION TITLE
12 CODE

13. TYPE OF BUILDING ☐ SEMI ☐ DET ☐ ROW ☐ APT ☐ COMM
14. CONSTRUCTION ☐ BRICK ☐ FRAME ☐ CON-CRETE ☐ STEEL ☐ OTHER
15. CONDITION OF BUILDING ☐ GOOD ☐ FAIR ☐ POOR
16. PAINT PEELING, OR CHIPPING SEEN ☐ Y ☐ N
17. IS FLAKING OF PLASTER SEEN ☐ Y ☐ N
18. WATER SERVICE PLUMBING ☐ COPPER ☐ GAL. IRON ☐ LEAD
19. TYPE OF CENTRAL HEATING ☐ FORCED AIR ☐ OTHER
20. IS THERE A BACK YARD ☐ Y ☐ N
21. IS IT USED BY CHILD AS A PLAY AREA ☐ Y ☐ N
22. TYPE OF SURFACE ☐ GRASS ☐ BARE EARTH ☐ HARD OR GRAVEL
23. HOUSEKEEPING ☐ GOOD ☐ FAIR ☐ POOR
24. DOES HOUSE NEED FREQUENT DUSTING ☐ Y ☐ N
25. IS DUST VISIBLE ON RUGS, FLOORS OR FURNITURE ☐ Y ☐ N
26. HYGIENE ☐ GOOD ☐ FAIR ☐ POOR
27. IS VACUUM OR WET MOP USED MOSTLY ☐ Y ☐ N
28. EVIDENCE OF PAINT PICA ☐ Y ☐ N
29. ARE HOME GROWN VEGETABLES EATEN ☐ Y ☐ N
30. SMALL OR LARGE AMOUNTS ☐ S ☐ L
32. WASHED ☐ Y NOT WASHED ☐ N
31. CHECK THOSE EATEN
BEANS 1 | BROC COLI 2 | CAB BAGE 3 | CAR ROTS 4 | CORN 5 | GARLIC 6 | LET TUCE (SALAD) 7 | ONIONS 8 | PEAS 9
PEP PERS 10 | RAD ISHES 11 | RHU BARB 12 | TOMA TOES 13 | OTHER 14 | SPECIFY
33. ARE FRUIT JUICES, ACID STEWS, TOMATOES, ETC., STORED IN CERAMIC, PEWTER, LEAD POTS OR CONTAINERS WITH SOLDER ☐ Y ☐ N
34. IS HOMEMADE WINE OR CIDER MADE OR STORED IN CERAMIC OR PORCELIN AT ANY TIME ☐ Y ☐ N
35. IS THERE A POT OF STEW OR SOUP CONSTANTLY SIMMERING ON THE STOVE ☐ Y ☐ N
36. DOES HOUSE USE CANNED MILK ☐ Y ☐ N
37. IF YES, BRAND NAME AND CODE
38. IS AN ELECTRIC KETTLE USED IN THE HOME ☐ Y ☐ N
39. KETTLE WATER SAMPLE TAKEN ☐ Y ☐ N
40. BRAND NAME
41. MODEL NO.
42. REMARKS:

37-176

TABLE 7.3
NUMBER OF RESPONSES TO PART TWO QUESTIONNAIRE

Questions	Toronto Refiners	Canada Metal	Prestolite	Control Area
Lead Worker in House	8	123	113	137
Occupation Title Code	0	1	0	3
Type of Building	10	134	107	137
Construction	9	123	103	138
Condition of Building	8	119	115	138
Paint Peeling or Chipping Seen	9	48	75	134
Is Plaster Flaking	9	37	75	133
Type of Plumbing	11	123	93	133
Type of Central Heating	2	8	75	132
Is There a Backyard	4	10	77	133
Backyard Used as a Play Area	2	8	75	131
Type of Surface in Backyard	2	8	76	129
Quality of Housekeeping	9	128	115	138
Does House Need Frequent Dusting	2	8	76	132
Is Dust Visible	2	9	75	131
Hygiene	7	114	113	139
Is a Vacuum or West Mop Used	2	8	75	132
Evidence of Paint Pica	2	10	78	131
Are Home Grown Vegetables Eaten	11	120	110	135
Small or Large Amounts	1	3	51	53
Beans	1	0	38	18
Broccoli	0	0	6	3
Cabbage	1	1	16	10
Carrots	0	1	9	9
Corn	0	0	2	7
Garlic	0	1	1	1
Lettuce	1	1	43	13
Onions	1	0	25	9
Peas	0	1	6	6
Peppers	0	1	28	10
Radishes	0	0	5	8
Rhubarb	0	0	1	1
Tomatoes	3	9	50	41
Other	0	2	5	23
Are Vegetables Washed	1	1	49	53
Lead Pots Used	11	128	115	137
Homemade Wine Stored in Porcelain/Ceramic	8	122	114	139
Is Stew or Soup Simmering	2	11	77	133
Do They Use Canned Milk	2	25	77	129
Canned Milk Name and Code	0	7	2	31
Is An Electric Kettle Used	2	25	78	129
Was Kettle Water Sample Taken	2	8	64	106
Kettle Brand Name and Code	0	7	7	25
Total Number of Questionnaires:	18	144	115	139

TABLE 7.4
NUMBER OF SAMPLES COLLECTED BY TYPE AND LOCATION
Toronto Refiners and Smelters Area

	Sample Types														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Wall	23			1											
Ceiling	2														
Floor	2		13												
Door Interior	2														
Door Exterior	2														
Door Frame Interior	1		1												
Door Frame Exterior	1														
Window Frame Interior															
Windowsill Frame Exterior	3														
Windowsill Interior	13		1												
Windowsill Exterior	2		1												
Area btw Inner & Outer Window	2														
Baseboard	2		1												
Stairs Tread & Riser	2		1		1										
Railing Interior	1														
Railing Exterior	4														
Kitchen Cupboards															
Highchair															
Crib															
Bed															
Dresser															
Fence	1														
Laundry Tub								2							
Kitchen Sink								9	2						
Hand Basin								1							
Isolated Water Tap								1							
Bookcase															
Chair															
Table															
Ceramics															
Baseboard															
Hot Air Duct	1		8												
Cold Air Return Duct			1												
Radiator															
Furnace			1												
Vacuum Cleaner			5												
Bathtub								3							
Light Fixtures															
Picture Frames															
Fireplace															
Exterior Siding	6														
Closet															
Soil Station No. 1						8	7								
Soil Station No. 2						1									
Soil Station No. 3						2	2								
Soil Station No. 4															
Soil Station No. 5															

SAMPLE TYPE CODE

01 – Paint	08 – Cold water "0" min.
02 – Short term dust	09 – Cold water "10" min.
03 – Long term dust	10 – Hot water "0" min.
04 – Wallpaper	11 – Hot water "10" min.
05 – Plaster	12 – Ceramics
06 – Soil 0-5 cm.	13 – Kettle water
07 – Soil 5-10 cm.	14 – Wine sample
	15 – Pickling liquid

TABLE 7.5
NUMBER OF SAMPLES COLLECTED BY TYPE AND LOCATION
Canada Metal Area

	Sample Types														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Wall	262		4	19	24										
Ceiling	21		1		4										
Floor	14	79	205		2										
Door Interior	52		6												
Door Exterior	8														
Door Frame Interior	58		26												
Door Frame Exterior	4														
Window Frame Interior	40		6		1										
Windowsill Frame Exterior	23		1												
Windowsill Interior	115	23	87		2										
Windowsill Exterior	14		2												
Area btw Inner & Outer Window	15		11												
Baseboard	45	2	13	1											
Stair Tread & Riser	31	8	52		4										
Railing Interior	6														
Railing Exterior	32														
Kitchen Cupboards	5		1												
Highchair	1														
Crib	5														
Bed	4		1												
Dresser	4		1												
Fence	2														
Laundry Tub	2		1					57	33						
Kitchen Sink								82	75		1	1			
Hand Basin								6	5						
Isolated Water Tap								4	3						
Bookcase															
Chair		1													
Table	1		2												
Ceramics			1												
Baseboard															
Hot Air Duct	3		32												
Cold Air Return Duct	1		38												
Radiator	3		1												
Furnace			55												
Vacuum Cleaner		2	21												
Bathtub	2							3							
Light Fixtures															
Picture Frames			2												
Fireplace															
Exterior Siding	26														
Closet	1		5												
Soil Station No. 1						50	40								
Soil Station No. 2						18	6								
Soil Station No. 3						31	9								
Soil Station No. 4						1									
Soil Station No. 5															

SAMPLE TYPE CODE

01 – Paint	08 – Cold water "0" min.
02 – Short term dust	09 – Cold water "10" min.
03 – Long term dust	10 – Hot water "0" min.
04 – Wallpaper	11 – Hot water "10" min.
05 – Plaster	12 – Ceramics
06 – Soil 0-5 cm.	13 – Kettle water
07 – Soil 5-10 cm.	14 – Wine sample
	15 – Pickling liquid

TABLE 7.6
NUMBER OF SAMPLES COLLECTED BY TYPE AND LOCATION
Prestolite Area

	Sample Types														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Wall	156	2	4	4	8										
Ceiling	7				1										
Floor	13	48	23												
Door Interior	20	1	9												
Door Exterior	11														
Door Frame Interior	22	7	58												
Door Frame Exterior	26		4												
Window Frame Interior	15	1	4												
Windowsill Frame Exterior	12		2												
Windowsill Interior	34	9	8		1										
Windowsill Exterior	5		1												
Area btw Inner & Outer Window	19	3	2												
Baseboard	36	10	1		2										
Stairs Tread & Riser	14	1	2												
Railing Interior	4														
Railing Exterior	15														
Kitchen Cupboards	5	1													
Highchair															
Crib	1														
Bed															
Dresser		3	4												
Fence															
Laundry Tub	2							3	3						
Kitchen Sink								113	112	26	25		7		
Hand Basin															
Isolated Water Tap															
Bookcase		2	1												
Chair	1														
Table		1	2												
Ceramics														2	9
Baseboard															
Hot Air Duct	2	9	19												
Cold Air Return Duct		5	23												
Radiator		1	2												
Furnace		2	41												
Vacuum Cleaner	1	9	23												
Bathtub															
Light Fixtures		1													
Picture Frames		1	11												
Fireplace			1												
Exterior Siding	6														
Closet	3	1	1												
Soil Station No. 1						50	44								
Soil Station No. 2						30	26								
Soil Station No. 3						20	14								
Soil Station No. 4															
Soil Station No. 5						2									

SAMPLE TYPE CODE

01 – Paint	08 – Cold water "0" min.
02 – Short term dust	09 – Cold water "10" min.
03 – Long term dust	10 – Hot water "0" min.
04 – Wallpaper	11 – Hot water "10" min.
05 – Plaster	12 – Ceramics
06 – Soil 0-5 cm.	13 – Kettle water
07 – Soil 5-10 cm.	14 – Wine sample
	15 – Pickling liquid

TABLE 7.7
NUMBER OF SAMPLES COLLECTED BY TYPE AND LOCATION
Control Area

	Sample Types														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Wall	264	14	11	101	64										
Ceiling	12				3										
Floor	11	39	77	1	2										
Door Interior	22	1	4		1										
Door Exterior	11														
Door Frame Interior	46	5	20												
Door Frame Exterior	7	1	3												
Window Frame Interior	35	2	7												
Windowsill Frame Exterior	15		2												
Windowsill Interior	147	17	42		1										
Windowsill Exterior	57	12	9		1										
Area btw Inner & Outer Window	15	1	6												
Baseboard	19	8	9												
Stairs Tread & Riser	10	9	22		1										
Railing Interior	5	1													
Railing Exterior	17														
Kitchen Cupboards	5		1	1									2		
Highchair															
Crib															
Bed	2														
Dresser			2												
Fence															
Laundry Tub								60	57						
Kitchen Sink								67	68	1			18		
Hand Basin								8	8				3		
Isolated Water Tap			1					1	1						
Bookcase		1													
Chair															
Table															
Ceramics															
Baseboard															
Hot Air Duct		1	14												
Cold Air Return Duct	1		18												
Radiator	1	1													
Furnace	1		36												
Vacuum Cleaner		1	12												
Bathtub								4	4						
Light Fixtures			1												
Picture Frames															
Fireplace															
Exterior Siding	5														
Closet															
Soil Station No. 1															
Soil Station No. 2															
Soil Station No. 3															
Soil Station No. 4															
Soil Station No. 5															

SAMPLE TYPE CODE

01 – Paint	08 – Cold water "0" min.
02 – Short term dust	09 – Cold water "10" min.
03 – Long term dust	10 – Hot water "0" min.
04 – Wallpaper	11 – Hot water "10" min.
05 – Plaster	12 – Ceramics
06 – Soil 0-5 cm.	13 – Kettle water
07 – Soil 5-10 cm.	14 – Wine sample
	15 – Pickling liquid

Tables 7.4-7.7 show clearly that because of the great variety of possible sample locations relatively few samples were collected from each. To ensure an adequate number of samples of each type for statistical analysis some categories were pooled. For example, 'paint from the door interior' or 'paint from window ledges' became part of 'paint from accessible surfaces'.

Thirty sample type and location combinations were defined and these are listed in Table 7.8.

Table 7.9 shows the number of samples collected for each of the listed sample type and location combinations for each area. Differences from Tables 7.4-7.7 in the total numbers for the two types of dust samples reflect changes in the definition of what constitutes 'long term' and 'short term' dust.

TABLE 7.8
POOLED SAMPLE TYPE AND LOCATION CODES

Sample Type	Location
Paint	—Accessible painted surfaces —Inaccessible painted areas —Floor
Short-term dust	—Miscellaneous accessible —Floor —Windowsill —Vacuum Cleaner
Long-term dust	—Miscellaneous Accessible —Floor —Windowsill —Inaccessible long term dust
Wallpaper	—Wallpapered area
Plaster	—Accessible —Inaccessible
Soil 0-5 cm.	—Topsoil
Soil 5-10 cm.	—Subsoil
Cold water "0" min.	—Laundry tub —Kitchen sink —Bathroom —Isolated water tap
Cold water "10" min.	—Laundry tub —Kitchen sink —Bathroom —Isolated water tap
Hot water "0" min.	—Kitchen sink
Hot water "10" min.	—Kitchen sink
Ceramics	
Kettle water	—Electric kettle
Wine sample	—Ceramics
Pickling liquid	—Ceramics

TABLE 7.9
NUMBER OF SAMPLES BY POOLED TYPE AND LOCATION

Type	Toronto Refiners	Canada Metal	Prestolite	Control Area
1. Paint—Accessible Surfaces	51	667	369	590
2. Paint—Inaccessible Surfaces	17	119	47	107
3. Paint—Floor	2	14	14	11
4. Short-Term Dust—Miscellaneous Access.	0	10	30	28
5. Short-Term Dust—From Floor	0	87	49	48
6. Short-Term Dust—From Windowsill	0	23	12	30
7. Short-Term Dust—From Vacuum	5	23	32	13
8. Long-Term Dust—Miscellaneous Access.	1	22	7	21
9. Long-Term Dust—Floor	14	259	25	99
10. Long-Term Dust—Windowsill	2	100	11	57
11. Long-Term Dust—Inaccessible	11	166	198	115
12. Wallpaper	1	20	4	103
13. Plaster—Accessible	1	32	11	70
14. Plaster—Inaccessible	0	5	1	3
15. Topsoil	11	100	102	0
16. Subsoil	9	55	84	0
17. Cold Water—Laundry Tub	2	57	3	60
18. Cold Water—Running—Laundry Tub	0	33	3	57
19. Cold Water—Kitchen Sink	9	82	113	67
20. Cold Water—Running—Kitchen Sink	2	75	112	68
21. Cold Water—Bathroom	4	9	0	12
22. Cold Water—Running—Bathroom	0	5	0	12
23. Cold Water—Isolated Water Tap	1	4	0	1
24. Cold Water—Running—Isolated Water Tap	0	3	0	1
25. Hot Water—Kitchen Sink	0	0	26	1
26. Hot Water—Running—Kitchen Sink	0	1	25	0
27. Ceramics	0	1	0	0
28. Kettle Water	0	0	7	23
29. Wine Sample	0	0	2	0
30. Pickling Liquid	0	0	9	0

CHAPTER 8
ANALYSIS OF EPIDEMIOLOGICAL SURVEY DATA

As we saw in Chapter 7, the epidemiological survey consisted of two questionnaires and a sampling program. It should be remembered that not all of the questions appearing on the final versions of the questionnaires were asked of all the people who took part in the study. Where the number of responses is small, the tests of statistical significance should be interpreted with some caution.

8.1 Analysis of Responses to Part One Questionnaire (Personal)

The Part One questionnaire was administered by the public health nurses and contained questions which were directed to individual participants. Consequently, Part One questionnaires were obtained from most people who lived in designated high, match or control houses and who had had a blood test.

The questionnaire contained two kinds of questions: those for which a non-numeric answer was needed (e.g. Have you had previous occupational lead exposure? Yes/No); and those for which a numerical answer was required (e.g. How many years have you lived in this house?). Since the method of statistical analysis for these two types of questions is different, they will be treated separately.

8.1.1 Non-Numeric Response Type Questions

In Tables 8.1, 8.2, 8.3, and 8.4, the responses for all people in an area have been pooled. Tables showing the responses for the adult/child/sex subgroupings are shown in *Appendix 8A*. The responses are categorized into two groups depending on whether the respondent had a blood lead level equal to or greater than 40 mcg or less than 40 mcg.

These two groups were compared statistically (chi-square) to determine if there was a significant difference in the distribution of their responses to the questions (Results of these tests are shown in the tables). Also shown are the mean distances from the plant for the combined high and low groups for each category of response to the questions.

The significance of the difference in mean distance is also given since some interpretations of the results might be altered if one group of respondents lived significantly closer to the plant than the other group. Where no significance level is given in the table it is because of the small number of responses in some categories.

The responses have also been pooled for the three plant areas so that a larger number of responses is available for statistical analysis of each question. This assumes that the responses to the questions are independent of area.

Results for the Control Area are not presented since there were so few elevated blood lead levels (3) in that area. A graphical presentation of the results is shown in Figure 8.1.

As can be seen in Tables 8.1, 8.2, 8.3 and 8.4, only for the birthplace and occupation questions were there sufficient responses in the TRS area to justify statiwtical analysis. This analysis showed that there was no significant difference in percentage of people with elevated blood lead levels according to their place of birth or occupation.

For the CM area the only statistically significant findings were that a higher percentage of people with elevated blood lead levels were born outside Toronto (53% vs. 38%); and a higher percentage of people with elevated blood leads had previous occupational lead exposure (19% vs. 5%).

Results of the previous occupational lead exposure question should be interpreted with care since children have been included in the above analysis despite the fact that they are hardly likely to have had occupational lead exposure and have all answered 'no' to that question. However, when the responses were subdivided in the adult/child and sex groups the following results were found: only female children exhibit the above finding related to place of birth; the adult male group, which comprises the majority of the people with previous occupational lead exposure shows no significant difference in previous occupational exposure between the high blood lead level group and the low blood lead level group. The lack of significance here may have resulted from the small number of responses in this group.

In the Pr area, too, a larger percentage of people born outside Toronto were found in the over 40 mcg blood lead level group (75% vs. 60%) than in the under 40 mcg blood lead level group. In the adult/child and sex groups, however, this trend is not evident. Table 8.4 also shows that all those people (3) who admitted to gasoline sniffing had elevated blood lead levels.

When the responses for the three plant areas are pooled the only statistically significant differences in the responses were found in the birthplace question and the

TABLE 8.1
COMPARISON OF RESPONSES TO THE
PART ONE EPIDEMIOLOGICAL SURVEY QUESTIONNAIRE
Toronto Refiners and Smelters

Question	Response	Number of Responses by Blood Lead Level Group ⩾40 (mcg/100 mls)	Number of Responses by Blood Lead Level Group <40 (mcg/100 mls)	Sign.	Mean Dist.	Sign.
Birthplace	Toronto	6	28	N.S.D.	193	N.S.D.
	Outside Toronto	12	48		204	
Occupation	Student	8	18			
	People Who Stay at Home	4	16	—	—	—
	Lead Worker	0	3			
	Other Workers	4	18			
Previous Occupational Lead Exposure	Yes	0	0	—	—	—
	No	5	11			
Lead Worker in House (Code 5 or 6)	Yes	0	0	—	—	—
	No	16	59			
Use Electric Kettle	Yes	0	0	—	—	—
	No	0	0			
History of Anemia	Yes	0	0	—	—	—
	No	0	0			
Gasoline Sniffing Admitted	Yes	0	0	—	—	—
	No	0	0			
Known to Ingest Paint	Yes	0	0	—	—	—
	No	0	0			
Known to Ingest Soil	Yes	0	0	—	—	—
	No	0	0			
Paint Pica	Yes	0	0	—	—	—
	No	0	0			
Do Others in House Smoke	Yes	0	0	—	—	—
	No	0	0			

TABLE 8.2
COMPARISON OF RESPONSES TO THE
PART ONE EPIDEMIOLOGICAL SURVEY QUESTIONNAIRE
Canada Metal

Question	Response	Number of Responses by Blood Lead Level Group ⩾40 (mcg/100 mls)	Number of Responses by Blood Lead Level Group <40 (mcg/100 mls)	Sign.	Mean Dist.	Sign.
Birthplace	Toronto	41	230	*	337	N.S.D.
	Outside Toronto	46	142		359	
Occupation	Student	50	168			
	People Who Stay at Home	19	47	—	—	—
	Lead Worker	5	9			
	Other Workers	7	46			
Previous Occupational Lead Exposure	Yes	6	4	*	251	N.S.D.
	No	26	80		325	
Lead Worker in House (Code 5 or 6)	Yes	9	22	N.S.D.	319	N.S.D.
	No	75	264		359	
Use Electric Kettle	Yes	0	0	—	—	—
	No	6	15			
History of Anemia	Yes	0	0	—	—	—
	No	3	10			
Gasoline Sniffing Admitted	Yes	0	0	—	—	—
	No	34	184			
Known to Ingest Paint	Yes	1	0	N.S.D.	—	—
	No	2	7			
Known to Ingest Soil	Yes	1	0	N.S.D.	—	—
	No	3	7			
Paint Pica	Yes	0	0	—	—	—
	No	3	7			
Do Others in House Smoke	Yes	4	13	N.S.D.	—	—
	No	0	3			

TABLE 8.3
COMPARISON OF RESPONSES TO THE
PART ONE EPIDEMIOLOGICAL SURVEY QUESTIONNAIRE
Prestolite

Question	Response	Number of Responses by Blood Lead Level Group ⩾40 (mcg/100 mls)	Number of Responses by Blood Lead Level Group <40 (mcg/100 mls)	Sign.	Mean Dist.	Sign.
Birthplace	Toronto	16	110		462	
	Outside Toronto	48	168	*	522	**
Occupation	Student	39	122			
	People Who Stay at Home	8	41	—	—	—
	Lead Worker	4	7			
	Other Workers	3	24			
Previous Occupational Lead Exposure	Yes	0	4	N.S.D.	326	
	No	51	152		506	***
Lead Worker in House (Code 5 or 6)	Yes	5	10	N.S.D.	395	
	No	54	188		509	***
Use Electric Kettle	Yes	0	0			
	No	2	15	—	—	—
History of Anemia	Yes	0	1	N.S.D.		
	No	3	14		—	—
Gasoline Sniffing Admitted	Yes	3	0			
	No	56	194	*	—	—
Known to Ingest Paint	Yes	0	0			
	No	2	15	—	—	—
Known to Ingest Soil	Yes	0	0			
	No	2	15	—	—	—
Paint Pica	Yes	0	0			
	No	3	16	—	—	—
Do Others in House Smoke	Yes	1	20	N.S.D.		
	No	0	21		—	—

TABLE 8.4
COMPARISON OF RESPONSES TO THE
PART ONE EPIDEMIOLOGICAL SURVEY QUESTIONNAIRE
All Plant Areas Combined

Question	Response	Number of Responses by Blood Lead Level Group ⩾40 (mcg/100 mls)	Number of Responses by Blood Lead Level Group <40 (mcg/100 mls)	Sign.	Mean Dist.	Sign.
Birthplace	Toronto	63	368		362	
	Outside Toronto	106	358	**	415	***
Occupation	Student	97	308			
	People Who Stay at Home	31	104	N.S.D.	—	—
	Lead Worker	9	19			
	Other Workers	14	88			
Previous Occupational Lead Exposure	Yes	6	8	N.S.D.	273	
	No	82	243		432	***
Lead Worker in House (Code 5 or 6)	Yes	14	32	N.S.D.	344	
	No	145	511		396	**
Use Electric Kettle	Yes	0	0			
	No	8	30	—	—	—
History of Anemia	Yes	0	1	N.S.D.		
	No	6	24		—	—
Gasoline Sniffing Admitted	Yes	3	0			
	No	90	378	**	—	—
Known to Ingest Paint	Yes	1	0	N.S.D.		
	No	4	22		—	—
Known to Ingest Soil	Yes	1	0	N.S.D.		
	No	5	22		—	—
Paint Pica	Yes	0	0			
	No	6	23	—	—	—
Do Others in House Smoke	Yes	5	33	N.S.D.	370	
	No	0	24		500	**

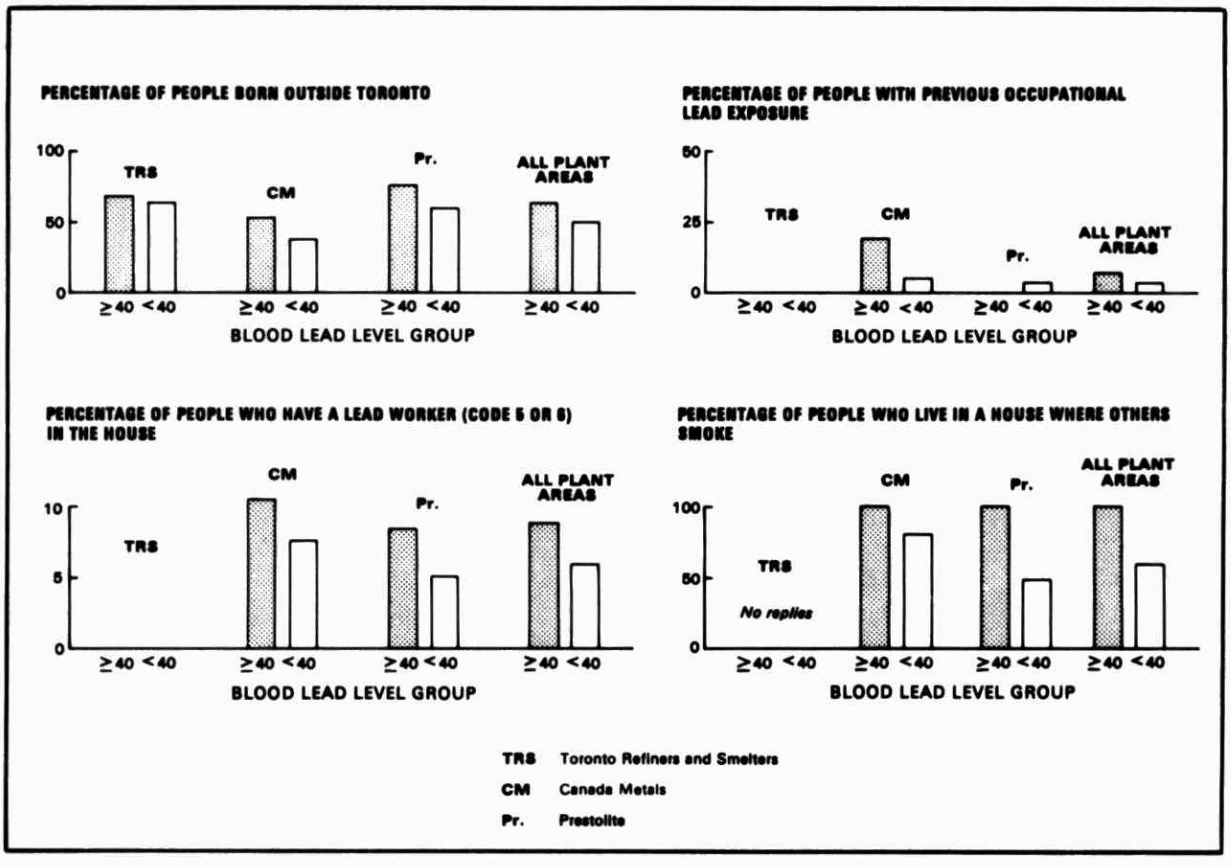


FIGURE 8.1 GRAPHIC COMPARISON OF RESPONSES TO SELECTED QUESTIONS FROM THE PART 1 EPIDEMIOLOGICAL QUESTIONNAIRE FOR THE HIGH (≥40 mcg/100 mls) AND LOW (<40 mcg/100 mls) BLOOD LEAD LEVEL GROUPS.

gasoline sniffing question. As we have seen, a greater percentage of people with elevated blood lead levels than with low blood lead levels (63% vs. 49%) were born outside Toronto. This result is statistically significant, and appears to come about mainly from differences in the female children group in which the difference appears despite the fact that the female children born in Toronto live some 50 m. closer to the plants on the average. It should be noted that the three people who admitted to gasoline sniffing had elevated blood lead levels, as did the one person who admitted ingesting paint and the one person known to ingest soil.

Some further analysis of the questions related to lead workers is in order here because of the obvious potential of this group to be subject to lead sources not available to the rest of the study population. As was discussed previously, the male adult population group is the major group subject to this potential source of lead, and consequently the following analyses are related to this group.

When considering the question of the effect of previous occupational lead exposure on blood lead levels it was found *(see Tables in Appendix 8A)* that only when results were combined for the three plant areas was a statistically significant difference found. It showed that male adults with previous occupational lead exposure were found in the elevated blood lead level group with significantly higher frequency (75% vs. 17%) than in the low blood lead level group. However, it must be noted that the group with previous occupational exposure (9 men) lived some 140 m. closer, on average, to the plant than did the 17 men who had no previous occupational exposure. This difference in distance from the plant is statistically significant and raises the question of whether proximity to the plant is responsible for the differences noted, rather than the previous occupational exposure.

To statistically analyze the 'present occupation' question we had to pool the responses for all three plant areas and also to pool the non-lead worker occupations into one group. These pooled numbers are given in Table 8.5.

TABLE 8.5
SUMMARY OF RESPONSES TO OCCUPATION QUESTION

Occupation Group	Number of Responses by Blood Lead Level Group	
	⩾40 mcg	<40 mcg
Non Lead Worker	20	62
Lead Worker	9(31%)	17(22%)

The chi-square value for Table 8.5 is 1.03 and is not significant. It should be remembered that a lead worker in this context refers to the very broad definition given in Appendix 7A. If a more restrictive definition of lead worker is taken (*code = 5 or 6; see Appendix 7A*) as meaning exposure to melted lead or lead dust then Table 8.6 would result.

TABLE 8.6
SUMMARY OF RESPONSES TO OCCUPATION QUESTION
(Restrictive Definition of Lead Worker)

Occupation Group	Number of Responses by Blood Lead Level Group	
	⩾40 mcg	<40 mcg
Non Lead Worker	27	78
Lead Worker	2(7%)	1(1%)

The chi-square value for Table 8.6 is 0.39 and is also not significant.

The question 'Is there a lead worker living in the house?' is of particular interest since the lead worker might bring home lead-bearing dust and lead particulate on his clothing and these might in turn be potential sources of lead for his family. In analyzing this question the more restrictive definition of a lead worker was used, but no relationship between lead worker in the house and elevated blood lead levels was found (see Tables 8.1, 8.2, 8.3 and 8.4) when all people in an area were pooled nor was any relationship found when the individual sex and adult/child groups were considered (*see Appendix 8A*).

8.1.2 Numeric Response Type Questions

Here again, the responses for all people in an area have been pooled. Tables showing results of analyses

TABLE 8.7
COMPARISON OF MEAN RESULTS TO NUMERIC RESPONSE TYPE QUESTIONS FOR PART ONE EPIDEMIOLOGICAL QUESTIONNAIRE

Questions	Blood Lead Level Group (mcg/100 mls)	Area															
		Toronto Refiners				Canada Metal				Prestolite				All Plant Areas Combined			
		Mean Result	Sign.	Mean Dist.	Sign.	Mean Result	Sign.	Mean Dist.	Sign.	Mean Result	Sign.	Mean Dist.	Sign.	Mean Result	Sign.	Mean Dist.	Sign.
Length of Residence This House	⩾40	4.7	NSD	147	*	7.7	NSD	342	NSD	5.6	NSD	488	NSD	6.5	NSD	377	NSD
	<40	6.3		214		9.2		360		6.2		501		7.7		398	
Length of Residence Plant Area	⩾40	6.1	NSD	148	*	7.6	NSD	350	NSD	5.9	NSD	488	NSD	6.8	NSD	379	NSD
	<40	6.5		214		9.1		367		6.3		499		7.8		401	
Daily Hours at Residence	⩾40	17.8	NSD	148	*	18.6	NSD	346	NSD	16.9	NSD	508	NSD	17.9	NSD	382	NSD
	<40	18.2		212		17.7		360		17.1		501		17.5		396	
Daily Hours Working or at School in Area	⩾40	6.4	NSD	122	***	6.8	NSD	365	NSD	7.7	NSD	519	NSD	7.1	NSD	396	NSD
	<40	5.9		230		6.8		365		8.2		483		7.2		399	
Daily Hours in the Area	⩾40	22.2	*	148	*	23.5	*	346	NSD	22.6	NSD	508	NSD	23.0	*	382	NSD
	<40	20.1		212		22.7		360		22.1		501		22.2		396	
Number of Packs of Cigarettes Per Day Smoked	⩾40	—	—	—	—	1.4	NSD	430	NSD	1.1	NSD	474	NSD	1.3	NSD	447	NSD
	<40	—		—		1.0		369		0.8		472		1.0		401	

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

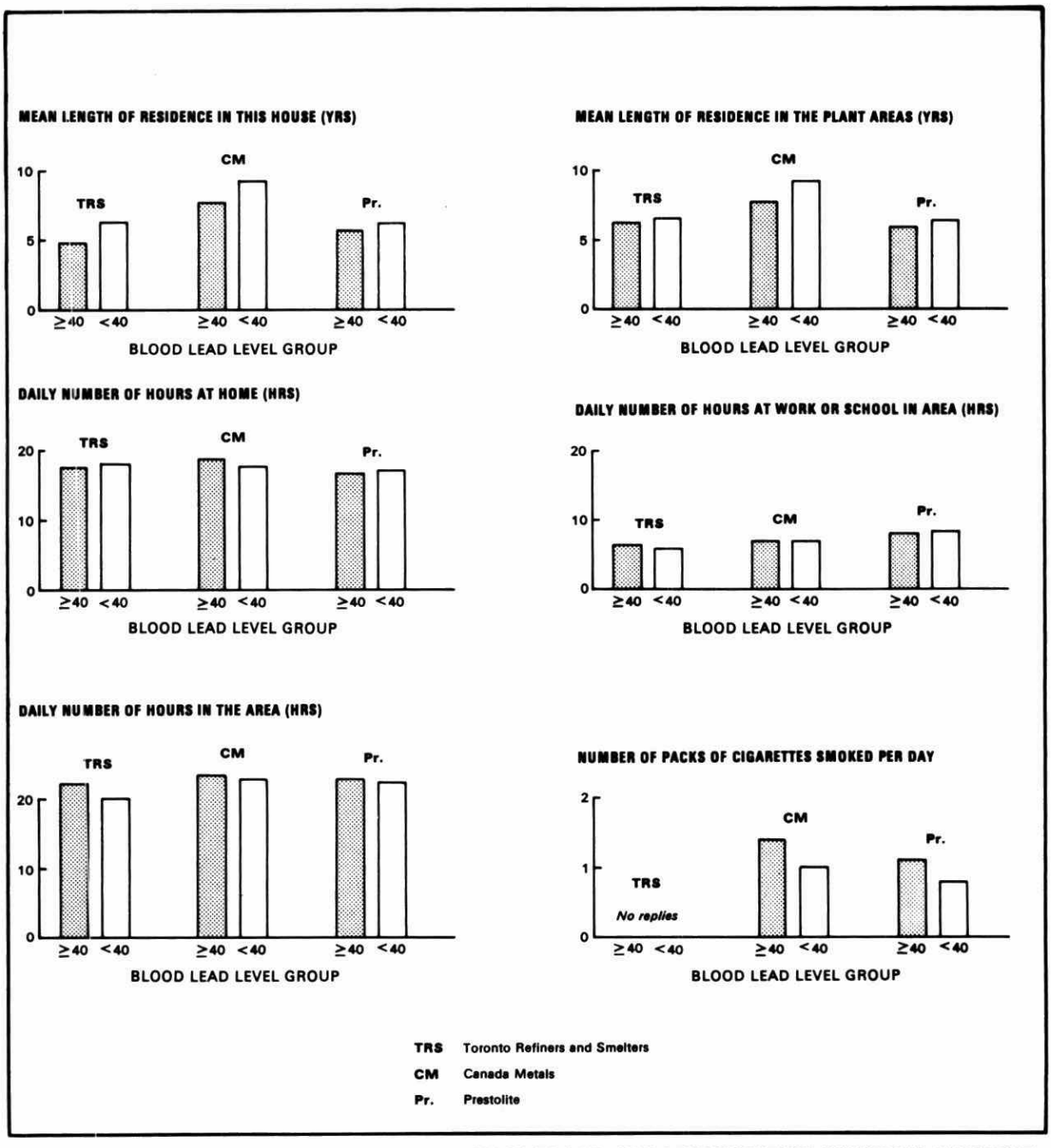


FIGURE 8.2 GRAPHIC COMPARISON OF MEAN RESULTS TO NUMERIC RESPONSE TYPE QUESTIONS FROM THE PART 1 EPIDEMIOLOGICAL QUESTIONNAIRE FOR THE HIGH (≥ 40 mcg/100 mls) AND LOW (<40 mcg/100 mls) BLOOD LEAD LEVEL GROUPS.

using the child and adult and sex subdivisions appear in *Appendix 8B*. Table 8.7 shows the mean response to each question categorized into two groups—for those people whose blood lead was equal to or greater than 40 mcg, and for those whose blood lead level was less than 40 mcg. Also shown, as in the previous section, are the significance level of the difference between the two groups and the mean distance for each group and the significance level of their difference.

Again, the results for the three plant areas have been pooled to form a larger group for statistical analysis, and these results are also shown in Figure 8.2.

As Table 8.7 shows, the only instance in which there was a statistically significant difference in the responses between the high and low groups was for the question 'How many hours per day do you spend in the area?' For the TRS and CM areas, and for the three areas pooled, the people with elevated blood lead levels spent statistically significantly more time on the average in the area than did the low group. The difference, although statistically significant, is small. It is interesting to note that the people surveyed in all three areas spend approximately 95 per cent of their time, on average, in the area. It was expected, and is the case, that the children spent virtually all their time, on average, in the area and hence no differences were found in the number of hours per day spent in the area between the high and low groups. The adult males in the TRS area with elevated blood lead levels spent on average four hours per day more in the area than did the group with blood lead levels below 40 mcg. This difference is statistically significant.

When the number of hours spent at home is considered, the female children group in the CM and Pr areas with elevated blood lead levels spent statistically significantly more time at home than did the low blood lead level group. This result was also found when the three areas were pooled.

It can also be noted that, for the female children in the three areas pooled, and in the CM area, those with elevated blood lead levels have lived statistically significantly fewer years in their present house and in the area. The difference is of the order of one to two years. However, both the high and low groups have lived in the areas for at least four years on average.

8.2 Analysis of Responses to Part Two Questionnaire (Household)

The Part Two questionnaire was administered by the public health inspectors and contained questions which related to the house and not to individuals. The houses surveyed were those identified as high houses and those selected as a match to each high; as well, a number of control houses were randomly selected from the Control Area.

The responses for high and match houses as groups were compared to determine whether the two groups responded to the questions asked in a significantly different way. Also, the responses obtained from high houses in each area and the responses for the Control Area houses were compared to see if there are statistically significant differences between these two groups based on their responses to the questions.

8.2.1 Comparison of High and Match Houses

Tables 8.8-8.11 summarize responses obtained at high and match houses in each area. Included are the results of chi-square tests to determine if there is a statistically significant difference between responses from the high houses and the match houses.

For the questions in the table for which neither a significance level nor the designation NSD (no significant difference) is given, no useful statistical analysis could be done, due either to the small number of responses or to certain answers being obtained only in rare instances: for example, in the TRS area, no house was reported as having visible dust, and so this question could not be used for analysis.

Since it is possible that the groups of respondents to these questions might be distributed unevenly with distance from the plant, distance must be considered in these analyses. For instance, a strongly significant finding that 'high houses had more lead workers resident in them' might need reinterpretation if the people who said there was a lead worker in the house lived generally closer to the plant than those who said there was not. In this case, the difference between high and match houses might be attributed partially or totally to proximity to the plant.

Consequently, the mean distances for the people in each category of response to each question are shown in the table and the significance of the difference between these distances is also indicated.

These results are presented for the three plant areas and also for all areas combined. The responses for the areas were combined so that a larger number of responses for each question were available for statistical analysis; this assumes that the responses are not area dependent.

Some of the results are also shown graphically in Figure 8.3.

As Tables 8.9-8.11 show, no statistically significant differences could be found for any of the questions for the TRS area, and this may be due partly to the limited number of high (11) and match (7) houses there. Chi-square tests could not be performed on some of the questions because of this same paucity of replies.

In the CM area, the only significant differences were in response to questions 9 (Is there a lead worker in the house?), 16 (Is paint peeling and chipping seen?) and 23 (Quality of the housekeeping). Replies to question 9 indicated that there were statistically significantly more high houses than match houses with lead worker occupants. The responses to question 16 showed that statistically significantly more paint peeling and chipping was seen in high houses. Replies to question 23 showed that housekeeping was more often categorized by the inspectors as 'fair to poor' in the high houses.

TABLE 8.8
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. MATCH HOUSES
Toronto Refiners and Smelters

Question	Answer	High	Match	Significance	Mean Dist.	Significance
Lead Worker in House	Yes	0	1			
	No	6	1	N.S.D.	—	—
Type of Building	Semi-detached	8	0			
	Detached	0	0			
	Row	0	2	—	—	—
	Apartment	0	0			
	Commercial	0	0			
Construction	Brick	7	2			
	Frame	0	0			
	Concrete	0	0	—	—	—
	Steel	0	0			
	Other	0	0			
Condition of Building	Good	4	1		220	
	Fair to Poor	2	1	N.S.D.	255	N.S.D.
Paint Peeling or Chipping Seen	Yes	2	0		170	
	No	5	2	N.S.D.	196	N.S.D.
Flaking of Plaster Seen	Yes	2	0		170	
	No	5	2	N.S.D.	196	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	7	1		180	
	Lead	2	1	N.S.D.	266	N.S.D.
Type of Central Heating	Forced Air	0	2			
	Other	0	0	—	—	—
Is There a Backyard	Yes	2	2			
	No	0	0	—	—	—
Yard Used as Play Area	Yes	0	1			
	No	0	1	—	—	—
Type of Surface in Yard	Grass	0	0			
	Bare Earth	0	1	—	—	—
	Hard Gravel	0	1			
Housekeeping	Good	5	1		216	
	Fair to Poor	2	1	N.S.D.	255	N.S.D.
Frequent Dusting Needed	Yes	0	1			
	No	0	1	—	—	—
Is There Visible Dust	Yes	0	0			
	No	0	2	—	—	—
Hygiene	Good	5	1			
	Fair to Poor	0	1	N.S.D.	—	—
Vacuum or Wet Mop	Yes	0	2			
	No	0	0	—	—	—
Evidence of Paint Pica	Yes	0	0			
	No	0	2	—	—	—
Home Grown Vegetables	Yes	3	1		249	
	No	6	1	N.S.D.	177	N.S.D.
Small or Large Amounts	Small	0	1			
	Large	0	0	—	—	—
Washed or Not Washed	Yes	0	1			
	No	0	0	—	—	—
Lead Pots Used	Yes	0	0			
	No	9	2	—	—	—
Homemade Wine	Yes	0	0			
	No	6	2	—	—	—
Simmering Stew	Yes	0	0			
	No	0	2	—	—	—
Canned Milk	Yes	0	0			
	No	0	2	—	—	
Electric Kettle Used	Yes	0	0			
	No	0	2	—	—	—

TABLE 8.9
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. MATCH HOUSES
Canada Metal

Question	Answer	High	Match	Significance	Mean Dist.	Significance
Lead Worker in House	Yes	23	9		333	
	No	33	56	**	346	N.S.D.
Type of Building	Semi-detached	53	56			
	Detached	12	6			
	Row	5	1	—	—	—
	Apartment	0	0			
	Commercial	0	1			
Construction	Brick	58	55			
	Frame	1	5			
	Concrete	0	0	—	—	—
	Steel	0	0			
	Other	3	1			
Condition of Building	Good	35	41		352	
	Fair to Poor	16	27	N.S.D.	344	N.S.D.
Paint Peeling or Chipping Seen	Yes	14	0		309	
	No	22	12	*	321	N.S.D.
Flaking of Plaster Seen	Yes	8	0		253	
	No	18	11	N.S.D.	333	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	57	51		360	
	Lead	7	8	N.S.D.	279	*
Type of Central Heating	Forced Air	3	5			
	Other	0	0	—	—	—
Is There a Backyard	Yes	5	5			
	No	0	0	—	—	—
Yard Used as Play Area	Yes	2	3		193	
	No	1	2	N.S.D.	415	N.S.D.
Type of Surface in Yard	Grass	1	1		150	
	Bare Earth	2	3	—	332	N.S.D.
	Hard Gravel	0	1		—	
Housekeeping	Good	36	58		362	
	Fair to Poor	24	10	**	339	N.S.D.
Frequent Dusting Needed	Yes	3	5			
	No	0	0	—	—	—
Is There Visible Dust	Yes	2	1		274	
	No	2	4	N.S.D.	321	N.S.D.
Hygiene	Good	36	59		373	
	Fair to Poor	10	8	N.S.D.	306	N.S.D.
Vacuum or Wet Mop	Yes	2	5			
	No	1	0	N.S.D.	—	—
Evidence of Paint Pica	Yes	0	0			
	No	5	5	—	—	—
Home Grown Vegetables	Yes	7	12		352	
	No	50	51	N.S.D.	358	N.S.D.
Small or Large Amounts	Small	3	0			
	Large	0	0	—	—	—
Washed or Not Washed	Yes	1	0			
	No	0	0	—	—	—
Lead Pots Used	Yes	0	0			
	No	60	68	—	—	—
Homemade Wine	Yes	1	2		598	
	No	52	67	N.S.D.	343	N.S.D.
Simmering Stew	Yes	0	0			
	No	4	7	—	—	—
Canned Milk	Yes	6	2		335	
	No	14	3	N.S.D.	313	N.S.D.
Electric Kettle Used	Yes	6	0		441	
	No	14	5	N.S.D.	282	N.S.D.

TABLE 8.10
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. MATCH HOUSES
Prestolite

Question	Answer	High	Match	Significance	Mean Dist.	Significance
Lead Worker in House	Yes	12	7		511	
	No	47	47	N.S.D.	508	N.S.D.
Type of Building	Semi-detached	45	39			
	Detached	5	16			
	Row	0	0	—	—	—
	Apartment	2	0			
	Commercial	0	0			
Construction	Brick	44	51			
	Frame	4	4			
	Concrete	0	0	N.S.D.	—	—
	Steel	0	0			
	Other	0	0			
Condition of Building	Good	51	49		517	
	Fair to Poor	9	6	N.S.D.	442	N.S.D.
Paint Peeling or Chipping Seen	Yes	0	4		384	
	No	22	49	N.S.D.	512	N.S.D.
Flaking of Plaster Seen	Yes	0	3		421	
	No	22	50	N.S.D.	509	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	40	46		498	
	Lead	7	0	*	443	N.S.D.
Type of Central Heating	Forced Air	19	45		503	
	Other	3	8	N.S.D.	478	N.S.D.
Is There a Backyard	Yes	22	46		489	
	No	0	9	N.S.D.	613	N.S.D.
Yard Used as Play Area	Yes	7	27		526	
	No	15	26	N.S.D.	498	N.S.D.
Type of Surface in Yard	Grass	9	19		476	
	Bare Earth	7	19	N.S.D.	549	N.S.D.
	Hard Gravel	7	15		485	
Housekeeping	Good	52	50		521	
	Fair to Poor	8	5	N.S.D.	396	N.S.D.
Frequent Dusting Needed	Yes	5	19		517	
	No	18	34	N.S.D.	494	N.S.D.
Is There Visible Dust	Yes	0	2		482	
	No	23	50	N.S.D.	508	N.S.D.
Hygiene	Good	54	49		519	
	Fair to Poor	6	4	N.S.D.	406	N.S.D.
Vacuum or Wet Mop	Yes	18	44		496	
	No	4	9	N.S.D.	520	N.S.D.
Evidence of Paint Pica	Yes	0	1			
	No	23	54	N.S.D.	—	—
Home Grown Vegetables	Yes	40	39		506	
	No	19	12	N.S.D.	498	N.S.D.
Small or Large Amounts	Small	13	36			
	Large	0	2	N.S.D.	—	—
Washed or Not Washed	Yes	12	37			
	No	0	0	—	—	—
Lead Pots Used	Yes	0	3		567	
	No	60	52	N.S.D.	505	N.S.D.
Homemade Wine	Yes	1	5		451	
	No	59	49	N.S.D.	513	N.S.D.
Simmering Stew	Yes	0	0			
	No	23	54	—	—	—
Canned Milk	Yes	1	1		588	
	No	21	54	N.S.D.	501	N.S.D.
Electric Kettle Used	Yes	4	4		533	
	No	20	50	N.S.D.	502	N.S.D.

TABLE 8.11
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. MATCH HOUSES
Three Plant Areas Combined

Question	Answer	High	Match	Significance	Mean Dist.	Significance
Lead Worker in House	Yes	35	17		396	
	No	87	107	**	418	N.S.D.
Type of Building	Semi-detached	106	96			
	Detached	17	23			
	Row	7	4	—	—	—
	Apartment	2	0			
	Commercial	0	1			
Construction	Brick	111	111			
	Frame	5	9			
	Concrete	0	0	—	—	—
	Steel	0	0			
	Other	3	1			
Condition of Building	Good	92	93		437	
	Fair to Poor	28	35	N.S.D.	364	*
Paint Peeling or Chipping Seen	Yes	17	4		307	
	No	49	63	**	434	**
Flaking of Plaster Seen	Yes	10	3		279	
	No	45	63	*	441	**
Type of Plumbing	Copper or Galvanized Iron	107	101		410	
	Lead	16	9	N.S.D.	323	*
Type of Central Heating	Forced Air	22	52		473	
	Other	3	8	N.S.D.	478	N.S.D.
Is There a Backyard	Yes	29	53		455	
	No	0	9	N.S.D.	613	N.S.D.
Yard Used as Play Area	Yes	9	31		477	
	No	16	29	N.S.D.	490	N.S.D
Type of Surface in Yard	Grass	10	20		454	
	Bare Earth	9	23	N.S.D.	505	N.S.D.
	Hard Gravel	7	17		472	
Housekeeping	Good	94	110		436	
	Fair to Poor	36	18	*	351	**
Frequent Dusting Needed	Yes	8	25		449	
	No	18	35	N.S.D.	493	N.S.D.
Is There Visible Dust	Yes	2	3		357	
	No	25	56	N.S.D.	490	N.S.D.
Hygiene	Good	97	112		440	
	Fair to Poor	17	13	N.S.D.	342	*
Vacuum or Wet Mop	Yes	20	51		471	
	No	5	9	N.S.D.	492	N.S.D.
Evidence of Paint Pica	Yes	0	1			
	No	28	61	N.S.D.	—	—
Home Grown Vegetables	Yes	52	52		466	
	No	76	67	N.S.D.	378	***
Small or Large Amounts	Small	16	37			
	Large	0	2	N.S.D.	—	—
Washed or Not Washed	Yes	13	38			
	No	0	0	—	—	—
Lead Pots Used	Yes	0	3		567	
	No	131	125	N.S.D.	411	N.S.D.
Homemade Wine	Yes	3	7		474	
	No	119	121	N.S.D.	416	N.S.D.
Simmering Stew	Yes	0	0			
	No	27	63	—	—	—
Canned Milk	Yes	7	3		385	
	No	35	59	N.S.D.	463	N.S.D.
Electric Kettle Used	Yes	10	4		493	
	No	34	57	*	452	N.S.D.

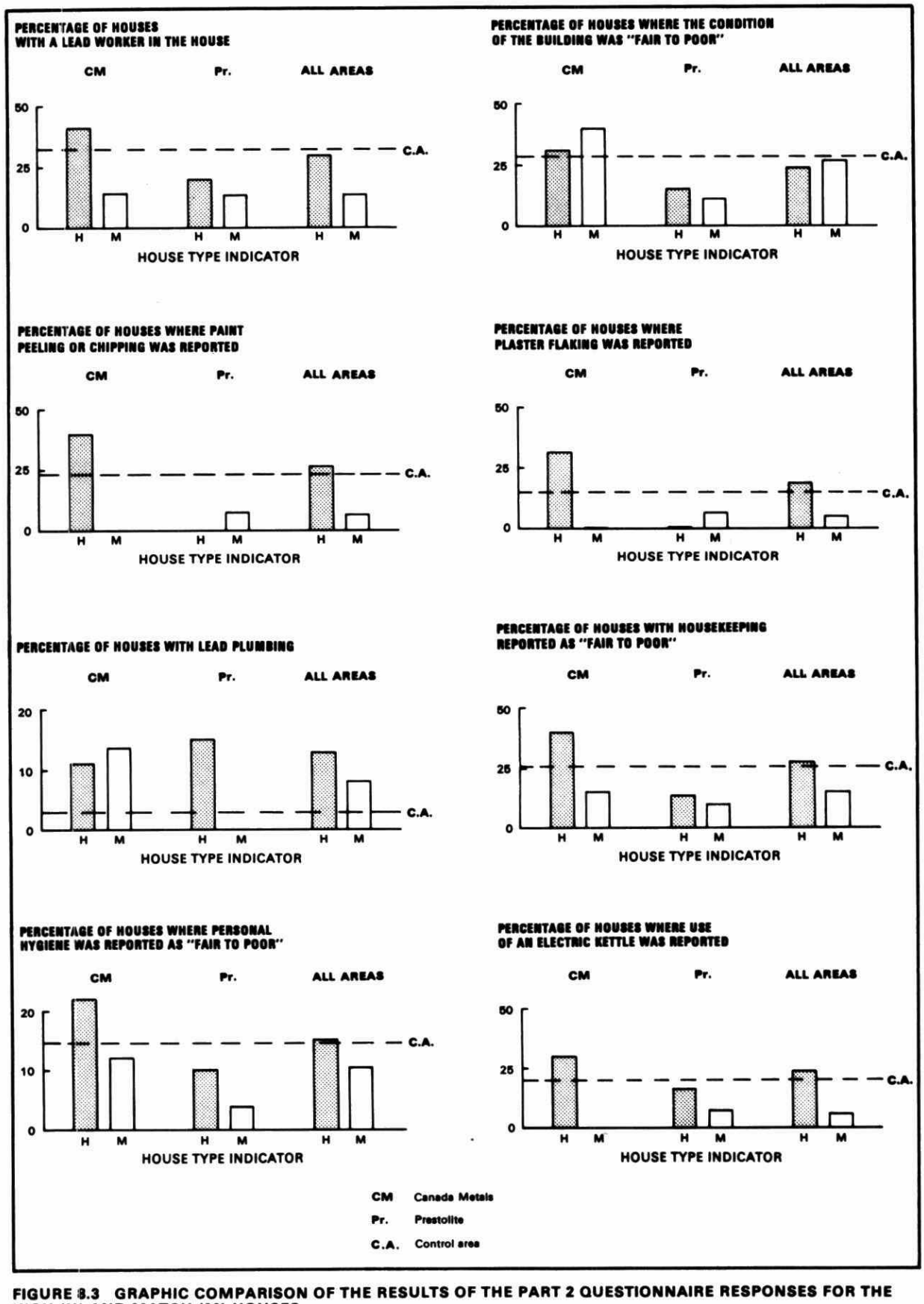

PERCENTAGE OF HOUSES WITH A LEAD WORKER IN THE HOUSE
CM
Pr.
ALL AREAS
50
25
0
C.A.
H
M
HOUSE TYPE INDICATOR
PERCENTAGE OF HOUSES WHERE THE CONDITION OF THE BUILDING WAS "FAIR TO POOR"
PERCENTAGE OF HOUSES WHERE PAINT PEELING OR CHIPPING WAS REPORTED
PERCENTAGE OF HOUSES WHERE PLASTER FLAKING WAS REPORTED
PERCENTAGE OF HOUSES WITH LEAD PLUMBING
20
10
PERCENTAGE OF HOUSES WITH HOUSEKEEPING REPORTED AS "FAIR TO POOR"
PERCENTAGE OF HOUSES WHERE PERSONAL HYGIENE WAS REPORTED AS "FAIR TO POOR"
PERCENTAGE OF HOUSES WHERE USE OF AN ELECTRIC KETTLE WAS REPORTED
CM Canada Metals
Pr. Prestolite
C.A. Control area

FIGURE 8.3 GRAPHIC COMPARISON OF THE RESULTS OF THE PART 2 QUESTIONNAIRE RESPONSES FOR THE HIGH (H) AND MATCH (M) HOUSES.

In none of these three questions was one group of respondents living statistically significantly closer to the plant than the corresponding group of respondents. For instance, the 'fair to poor' housekeeping group lived very nearly the same distance from the plant, on average, as did those living in houses where the housekeeping was reported as good. Consequently in these three questions proximity to the plant does not seem to bias the results.

In the Pr area the only statistically significant difference was found to be in the type of plumbing used in the high and match houses: people in houses with lead piping were statistically more likely to have elevated blood lead levels, although this conclusion is based on a very limited number of houses (7) in which lead piping was found.

When all areas are considered together, improved statistical analysis can be done since there is a greater number of responses to each of the questions, and we found statistically significant differences in responses for five of them: high houses more often had a lead worker occupant than did the match houses; peeling or chipping paint occurred more frequently in the high houses; there was more plaster chipping and flaking in the high houses; there was more 'fair to poor' housekeeping in the high houses; and finally, electric kettles were more often used in the high houses.

In the responses to the paint peeling and plaster flaking questions, it should be noted that the 'yes' response group lived statistically significantly closer to the plants than did the 'no' response group, indicating that proximity to the lead plants may be a factor to consider as well as the paint peeling and plaster flaking. The results also show that the 'poor to fair' housekeeping group lived significantly closer (80 m. on average) to the plants than did the 'good' housekeeping group.

8.2.2 Comparison of High and Control Houses

The high houses for each area may also be compared with the control houses selected from the Control Area in order to determine if any significant differences between the two groups can be found in their responses to the questionnaire. Tables 8.12-8.15 summarize the responses to the questionnaire for the two groups and also show the significance of any differences.

For the TRS area the only statistically significant finding was that the high houses were more likely to have lead plumbing than were the control houses from the Control Area, although this result is based on only six houses with lead plumbing. For the other questions no significant differences were found where there were enough responses to analyze.

For the CM area no significant difference in responses could be found between high and control houses, except in the case of question 29. The responses to this question showed that a higher percentage of people in the control houses than in the high ones ate home-grown vegetables.

In the Pr area we found that home-grown vegetables were eaten in a higher percentage of the houses surveyed than in the Control Area control houses. We also found that a higher percentage of people in the control houses used their backyards as play areas than was the case in the high houses in the Pr area. A greater percentage of people in the Control Area houses reported that frequent dusting was needed—and that dust was visible—than was the case in the high houses in the Pr area. In addition, paint peeling was found in a higher percentage of homes in the Control Area than in the high houses of the Pr area.

It should be kept in mind that although these results indicate that a greater percentage of the population in the Control Area is at risk from peeling paint, dust etc., the risk would only be greater if the lead content of paint and dust in the Control Area houses was higher than in the houses in the Pr Area. The results of sampling surveys conducted to determine the lead content of paint, dust, etc. will be discussed later in this chapter.

The responses from all areas combined showed that the high houses had a higher percentage of lead water pipes as compared to the Control Area houses. There were also significant differences for questions 21 and 24, indicating that frequent dusting was more often necessary in houses in the Control Area and that backyards were also more frequently used as play areas in the Control Area.

TABLE 8.12
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. CONTROL HOUSES
Toronto Refiners and Smelters

Question	Answer	High	Control	Significance
Lead Worker in House	Yes	0	43	
	No	6	89	N.S.D.
Type of Building	Semi-detached	8	48	
	Detached	0	22	
	Row	0	59	—
	Apartment	0	3	
	Commercial	0	0	
Construction	Brick	7	108	
	Frame	0	22	
	Concrete	0	0	—
	Steel	0	0	
	Other	0	3	
Condition of Building	Good	4	94	
	Fair to Poor	2	37	N.S.D.
Paint Peeling or Chipping Seen	Yes	2	31	
	No	5	102	N.S.D.
Flaking of Plaster Seen	Yes	2	20	
	No	5	113	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	7	123	*
	Lead	2	4	
Type of Central Heating	Forced Air	0	116	—
	Other	0	16	
Is There a Backyard	Yes	2	123	
	No	0	10	N.S.D.
Yard Used as Play Area	Yes	0	91	
	No	0	40	—
Type of Surface in Yard	Grass	0	88	
	Bare Earth	0	30	—
	Hard Gravel	0	11	
Housekeeping	Good	5	98	
	Fair to Poor	2	34	N.S.D.
Frequent Dusting Needed	Yes	0	76	
	No	0	56	—
Is There Visible Dust	Yes	0	30	
	No	0	101	—
Hygiene	Good	5	114	
	Fair to Poor	0	19	N.S.D.
Vacuum or Wet Mop	Yes	0	112	
	No	0	20	—
Evidence of Paint Pica	Yes	0	11	
	No	0	120	—
Home Grown Vegetables	Yes	3	58	
	No	6	71	N.S.D.
Small or Large Amounts	Small	0	49	
	Large	0	4	—
Washed or Not Washed	Yes	0	52	
	No	0	1	—
Lead Pots Used	Yes	0	1	
	No	9	131	N.S.D.
Homemade Wine	Yes	0	3	
	No	6	130	N.S.D.
Simmering Stew	Yes	0	0	
	No	0	133	—
Canned Milk	Yes	0	33	
	No	0	96	—
Electric Kettle Used	Yes	0	26	
	No	0	103	—

TABLE 8.13
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. CONTROL HOUSES
Canada Metal

Question	Answer	High	Control	Significance
Lead Worker in House	Yes	23	43	
	No	33	89	N.S.D.
Type of Building	Semi-detached	53	48	
	Detached	12	22	
	Row	5	59	—
	Apartment	0	3	
	Commercial	0	0	
Construction	Brick	58	108	
	Frame	1	22	
	Concrete	0	0	—
	Steel	0	0	
	Other	3	3	
Condition of Building	Good	35	94	
	Fair to Poor	16	37	N.S.D.
Paint Peeling or Chipping Seen	Yes	14	31	
	No	22	102	N.S.D.
Flaking of Plaster Seen	Yes	8	20	
	No	18	113	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	57	123	N.S.D.
	Lead	7	4	
Type of Central Heating	Forced Air	3	116	
	Other	0	16	N.S.D.
Is There a Backyard	Yes	5	123	
	No	0	10	N.S.D.
Yard Used as Play Area	Yes	2	91	
	No	1	40	N.S.D.
Type of Surface in Yard	Grass	1	88	
	Bare Earth	2	30	N.S.D.
	Hard Gravel	0	11	
Housekeeping	Good	36	98	
	Fair to Poor	24	34	N.S.D.
Frequent Dusting Needed	Yes	3	76	
	No	0	56	N.S.D.
Is There Visible Dust	Yes	2	30	
	No	2	101	N.S.D.
Hygiene	Good	36	114	
	Fair to Poor	10	19	N.S.D.
Vacuum or Wet Mop	Yes	2	112	
	No	1	20	N.S.D.
Evidence of Paint Pica	Yes	0	11	
	No	5	120	N.S.D.
Home Grown Vegetables	Yes	7	58	
	No	50	71	***
Small or Large Amounts	Small	3	49	
	Large	0	4	N.S.D.
Washed or Not Washed	Yes	1	52	
	No	0	1	N.S.D.
Lead Pots Used	Yes	0	1	
	No	60	131	N.S.D.
Homemade Wine	Yes	1	3	
	No	52	130	N.S.D.
Simmering Stew	Yes	0	0	
	No	4	133	—
Canned Milk	Yes	6	33	
	No	14	96	N.S.D.
Electric Kettle Used	Yes	6	26	
	No	14	103	N.S.D.

TABLE 8.14
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. CONTROL HOUSES
Prestolite

Question	Answer	High	Control	Significance
Lead Worker in House	Yes	12	43	
	No	47	89	N.S.D.
Type of Building	Semi-detached	45	48	
	Detached	5	22	
	Row	0	59	—
	Apartment	2	3	
	Commercial	0	0	
Construction	Brick	44	108	
	Frame	4	22	
	Concrete	0	0	—
	Steel	0	0	
	Other	0	3	
Condition of Building	Good	51	94	
	Fair to Poor	9	37	N.S.D.
Paint Peeling or Chipping Seen	Yes	0	31	
	No	22	102	*
Flaking of Plaster Seen	Yes	0	20	
	No	22	113	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	40	123	*
	Lead	7	4	
Type of Central Heating	Forced Air	19	116	
	Other	3	16	N.S.D.
Is There a Backyard	Yes	22	123	
	No	0	10	N.S.D.
Yard Used as Play Area	Yes	7	91	
	No	15	40	**
Type of Surface in Yard	Grass	9	88	
	Bare Earth	7	30	—
	Hard Gravel	7	11	
Housekeeping	Good	52	98	
	Fair to Poor	8	34	N.S.D.
Frequent Dusting Needed	Yes	5	76	
	No	18	56	**
Is There Visible Dust	Yes	0	30	
	No	23	101	*
Hygiene	Good	54	114	
	Fair to Poor	6	19	N.S.D.
Vacuum or Wet Mop	Yes	18	112	
	No	4	20	N.S.D.
Evidence of Paint Pica	Yes	0	11	
	No	23	120	N.S.D.
Home Grown Vegetables	Yes	40	58	
	No	19	71	**
Small or Large Amounts	Small	13	49	
	Large	0	4	N.S.D.
Washed or Not Washed	Yes	12	52	
	No	0	1	N.S.D.
Lead Pots Used	Yes	0	1	
	No	60	131	N.S.D.
Homemade Wine	Yes	1	3	
	No	59	130	N.S.D.
Simmering Stew	Yes	0	0	
	No	23	133	—
Canned Milk	Yes	1	33	
	No	21	96	N.S.D.
Electric Kettle Used	Yes	4	26	
	No	20	103	N.S.D.

TABLE 8.15
COMPARISON OF RESULTS
OF PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE RESPONSES
HIGH VS. CONTROL HOUSES
Three Plant Areas Combined

Question	Answer	High	Control	Significance
Lead Worker in House	Yes	35	43	
	No	87	89	N.S.D.
Type of Building	Semi-detached	106	48	
	Detached	17	22	
	Row	7	59	—
	Apartment	2	3	
	Commercial	0	0	
Construction	Brick	111	108	
	Frame	5	22	
	Concrete	0	0	—
	Steel	0	0	
	Other	3	3	
Condition of Building	Good	92	94	
	Fair to Poor	28	37	N.S.D.
Paint Peeling or Chipping Seen	Yes	17	31	
	No	49	102	N.S.D.
Flaking of Plaster Seen	Yes	10	20	
	No	45	113	N.S.D.
Type of Plumbing	Copper or Galvanized Iron	107	123	**
	Lead	16	4	
Type of Central Heating	Forced Air	22	116	
	Other	3	16	N.S.D.
Is There a Backyard	Yes	29	123	
	No	0	10	N.S.D.
Yard Used as Play Area	Yes	9	91	
	No	16	40	**
Type of Surface in Yard	Grass	10	88	
	Bare Earth	9	30	—
	Hard Gravel	7	11	
Housekeeping	Good	94	98	
	Fair to Poor	36	34	N.S.D.
Frequent Dusting Needed	Yes	8	76	
	No	18	56	*
Is There Visible Dust	Yes	2	30	
	No	25	101	N.S.D.
Hygiene	Good	97	114	
	Fair to Poor	17	19	N.S.D.
Vacuum or Wet Mop	Yes	20	112	
	No	5	20	N.S.D.
Evidence of Paint Pica	Yes	0	11	
	No	28	120	N.S.D.
Home Grown Vegetables	Yes	52	58	
	No	76	71	N.S.D.
Small or Large Amounts	Small	16	49	
	Large	0	4	N.S.D.
Washed or Not Washed	Yes	13	52	
	No	0	1	N.S.D.
Lead Pots Used	Yes	0	1	
	No	131	131	N.S.D.
Homemade Wine	Yes	3	3	
	No	119	130	N.S.D.
Simmering Stew	Yes	0	0	
	No	27	133	—
Canned Milk	Yes	7	33	
	No	35	96	N.S.D.
Electric Kettle Used	Yes	10	26	
	No	34	103	N.S.D.

8.3 Analysis of Part Two Sampling Survey Results

Samples collected by the City of Toronto were placed in 30 groups according to type and source as described in Chapter 7. The numbers of samples collected at each house varied, and in no case were samples of all 30 types collected at any one house; in fact, since generally only about five to ten samples were taken at each house there were some categories for which very little information was accumulated.

8.3.1. Group Analysis

In this section we shall consider the data for the groups (as previously defined), that is, high, match and control houses.

Table 8.16 shows, for each of the 30 sample types, the arithmetic mean and the number of cases upon which it is based. It also shows the significance levels attached to the differences between the means of the high and match houses, and the high and control houses.

TABLE 8.16
AVERAGE LEAD LEVEL BY AREA
OF THE PART TWO EPIDEMIOLOGICAL SURVEY
SAMPLES FOR HIGH, MATCH AND CONTROL HOUSES

Paint Accessible Surfaces	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	17340 (10)	7417 (5)	34722 (124)	NSD	NSD
Canada Metal	29147 (71)	16350 (67)	34722 (124)	**	NSD
Prestolite	18450 (58)	34971 (50)	34722 (124)	*	*

Paint Inaccessible Surfaces	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	27868 (8)	50533 (6)	81787 (55)	NSD	NSD
Canada Metal	53271 (50)	54729 (27)	81787 (55)	NSD	NSD
Prestolite	47909 (8)	32802 (24)	81787 (55)	NSD	NSD

Paint from Floor	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	2500 (2)	—	6188 (8)	—	NSD
Canada Metal	24500 (7)	9430 (5)	6188 (8)	NSD	NSD
Prestolite	35000 (3)	40705 (9)	6188 (8)	NSD	NSD

Short Term Dust Miscellaneous Access.	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	—	1576 (23)	—	—
Canada Metal	2010 (5)	4750 (1)	1576 (23)	—	NSD
Prestolite	1646 (12)	1796 (9)	1576 (23)	NSD	NSD

Short Term Dust From the Floor	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	—	2659 (33)	—	—
Canada Metal	2788 (29)	10777 (19)	2659 (33)	NSD	NSD
Prestolite	8947 (16)	1508 (18)	2659 (33)	NSD	NSD

Short Term Dust From Windowsill	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	—	22111 (19)	—	—
Canada Metal	4125 (4)	10795 (5)	22111 (19)	**	NSD
Prestolite	8180 (5)	19420 (5)	22111 (19)	NSD	NSD

Short Term Dust From Vacuum Cleaner	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	1800 (5)	—	1017 (12)	—	NSD
Canada Metal	1588 (16)	2450 (6)	1017 (12)	NSD	*
Prestolite	957 (7)	839 (23)	1017 (12)	NSD	NSD

TABLE 8.16 (Cont'd.)
AVERAGE LEAD LEVEL BY AREA
OF THE PART TWO EPIDEMIOLOGICAL SURVEY
SAMPLES FOR HIGH, MATCH AND CONTROL HOUSES

Long Term Dust Miscellaneous Access.	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	500 (1)	—	1905 (13)	—	—
Canada Metal	3235 (11)	1463 (4)	1905 (13)	NSD	NSD
Prestolite	1100 (2)	1000 (5)	1905 (13)	NSD	NSD

Long Term Dust From Floor	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	2825 (4)	2500 (4)	3849 (44)	NSD	NSD
Canada Metal	3206 (33)	6601 (49)	3849 (44)	NSD	NSD
Prestolite	1468 (15)	1400 (2)	3849 (44)	NSD	NSD

Long Term Dust From Windowsill	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	47500 (1)	—	19071 (36)	—	—
Canada Metal	7720 (18)	11988 (38)	19071 (36)	NSD	NSD
Prestolite	1975 (4)	2140 (5)	19071 (36)	NSD	NSD

Long Term Dust Inaccessible	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	2560 (5)	1100 (4)	3175 (50)	NSD	NSD
Canada Metal	3173 (60)	2902 (40)	3175 (50)	NSD	NSD
Prestolite	2309 (47)	1330 (46)	3175 (50)	NSD	NSD

Wallpaper	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	3000 (1)	—	3452 (49)	—	—
Canada Metal	3533 (9)	1392 (6)	3452 (49)	NSD	NSD
Prestolite	1700 (1)	500 (1)	3452 (49)	—	—

Plaster Accessible	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	2000 (1)	—	3065 (46)	—	—
Canada Metal	7820 (5)	2907 (21)	3065 (46)	NSD	NSD
Prestolite	3400 (7)	1600 (3)	3065 (46)	NSD	NSD

Topsoil	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	2732 (9)	—	—	—	—
Canada Metal	1013 (57)	975 (4)	—	NSD	—
Prestolite	739 (5)	706 (22)	—	NSD	—

Subsoil	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	1411 (9)	—	—	—	—
Canada Metal	1222 (41)	500 (1)	—	—	—
Prestolite	323 (2)	578 (21)	—	NSD	—

TABLE 8.16 (Cont'd.)
AVERAGE LEAD LEVEL BY AREA
OF THE PART TWO EPIDEMIOLOGICAL SURVEY
SAMPLES FOR HIGH, MATCH AND CONTROL HOUSES

Cold Water "0" Min. Laundry Tub	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	.011 (1)	.005 (1)	.013 (55)	—	—
Canada Metal	.021 (34)	.020 (20)	.013 (55)	NSD	*
Prestolite	.002 (1)	.006 (1)	.013 (55)	—	—

Cold Water "0" Min. Kitchen Sink	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	.020 (4)	.009 (5)	.016 (65)	NSD	NSD
Canada Metal	.017 (35)	.021 (41)	.016 (65)	NSD	NSD
Prestolite	.013 (57)	.007 (50)	.016 (65)	**	NSD

Cold Water "0" Min. Bathroom	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	.011 (2)	.013 (1)	.021 (10)	—	NSD
Canada Metal	.028 (5)	.109 (4)	.021 (10)	NSD	NSD
Prestolite	—	—	.021 (10)	—	—

Cold Water "Running" Laundry Tub	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	—	.011 (52)	—	—
Canada Metal	.008 (12)	.027 (20)	.011 (52)	NSD	NSD
Prestolite	.002 (1)	.004 (1)	.011 (52)	—	—

Cold Water "Running" Kitchen Sink	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	.011 (2)	.009 (66)	—	—
Canada Metal	.009 (23)	.021 (41)	.009 (66)	NSD	NSD
Prestolite	.010 (56)	.004 (50)	.009 (66)	***	NSD

Cold Water "Running" Bathroom	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	—	.010 (10)	—	—
Canada Metal	.006 (1)	.020 (4)	.010 (10)	—	—
Prestolite	—	—	.010 (10)	—	—

Kettle Water	Average (ppm)			T-Test	
	High Houses	Match Houses	Control	H-M	H-C
Toronto Refiners	—	—	.056 (22)	—	—
Canada Metal	—	—	.056 (22)	—	—
Prestolite	.108 (4)	.037 (3)	.056 (22)	NSD	NSD

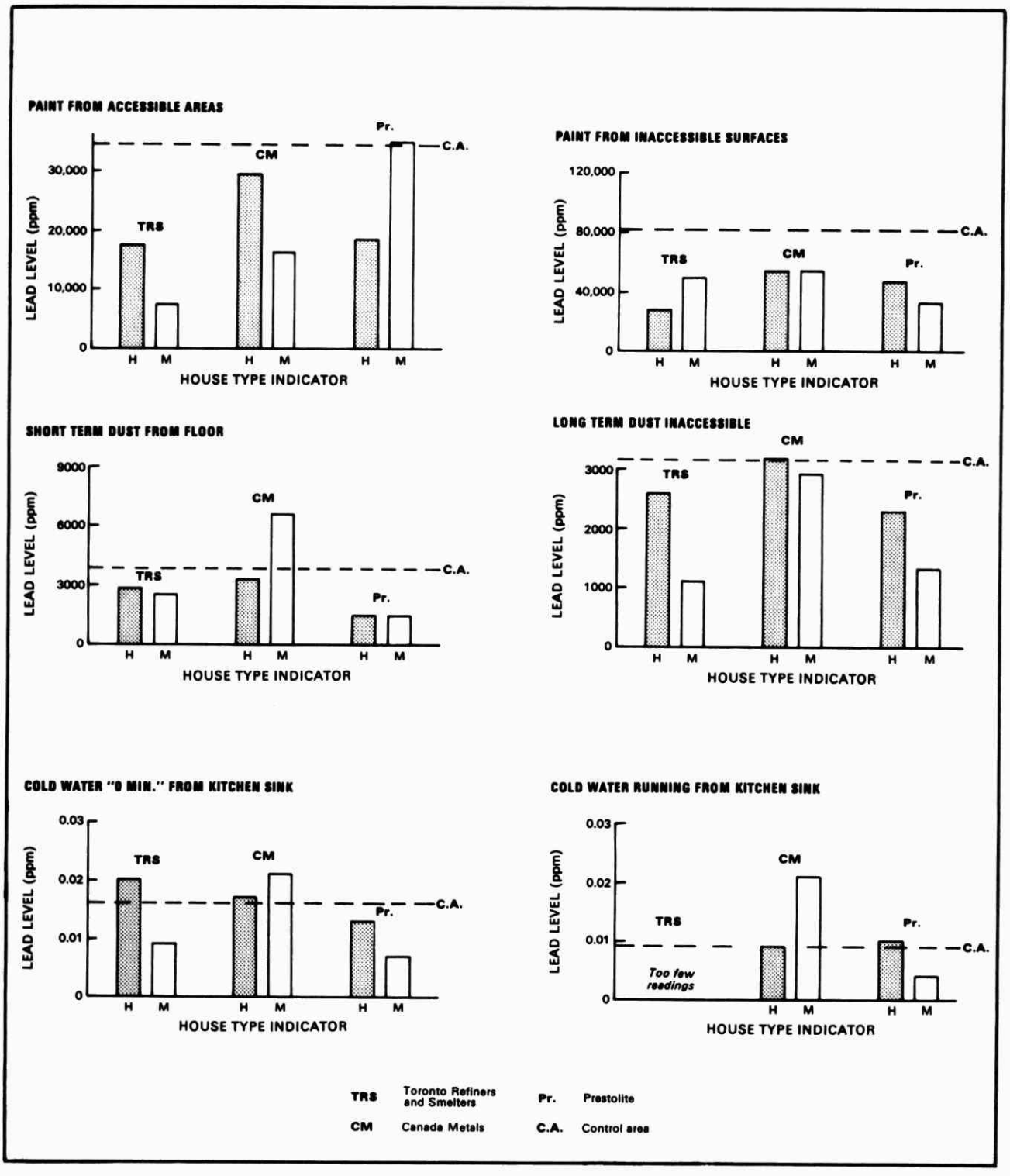


FIGURE 8.4 GRAPHIC COMPARISON OF ARITHMETIC MEAN LEAD LEVELS (ppm) IN HOUSEHOLD SAMPLES FOR HIGH (H) AND MATCH (M) HOUSES.

Table 8.16 shows that when high and match houses are compared the only samples for which there is a statistically significant difference in the means were: paint from accessible surfaces (CM and Pr); and water from the kitchen sink (Pr). The paint from accessible surfaces in the CM area was significantly higher in mean lead level than were similar samples from the match houses. However, there was no significant difference in mean lead level of paint from accessible surfaces between the high houses in the CM area and the control houses. The match houses in the Pr area had mean lead levels in paint from accessible surfaces which were statistically significantly higher than was found in high houses in the same area. For the water from the kitchen sink, the Pr area high houses had significantly higher mean lead levels than did the match houses.

Comparisons between high and control houses showed that higher mean lead levels were found in the high houses in the CM area than in control houses for 'dust from vacuum cleaners' and 'water from laundry tub' samples. It was also found that the control houses had mean lead levels in paint from accessible surfaces which were significantly higher than in the high houses in the Pr area.

In all the other sample categories there were either too few cases to analyze or there was no significant difference between the means.

8.3.2. Regression Analysis

A second method of investigating the influence of potential sources of lead on human blood lead levels is by using regression analysis—relating the blood lead levels of the individual to lead levels of the various potential sources in his environment. Among the confounding factors which may affect such potential relationships are age and sex. Separate regressions were therefore done for adult and child, and male and female, groups; age was added as a co-variable.

Tables 8.17 and 8.18 summarize the factors for which there is a statistically significant relationship for each area separately, and for all areas combined.

A set of Tables showing the regression coefficients appears in *Appendix 8C* of this report.

The data for all areas combined show that, among the male children, topsoil was the only statistically significant related factor; dust from windowsills showed a significant regression but a negative coefficient—in other words, as the lead level in the dust increases, the blood lead level decreases.

For the female children, short-term dust from the floor, as well as subsoil, showed a positive regression with blood lead indicating that as lead in these samples increased so did blood lead levels.

Among male adults, the lead content of kettle water, long-term inaccessible dust, paint from accessible surfaces, and subsoil, all showed a positive relationship to elevated blood lead levels. Cold water running from the laundry tub faucets showed a negative relationship with blood lead levels.

For the female adults, only cold water samples taken when the water is first turned on showed a statistically significant relationship to elevated blood lead levels.

The results for each area individually are shown in Table 8.18.

TABLE 8.17
SUMMARY OF RESULTS OF REGRESSION ANALYSIS
OF BLOOD LEAD LEVELS VS. ENVIRONMENTAL RESULTS
ALL AREAS COMBINED

Group	All Areas
Male Children	Topsoil** (107) Subsoil* (89) S.T. Dust Windowsill* (36) (–ve coeff.)
Female Children	S.T. Dust—Floor*** (96) S.T. Dust—Vacuum Cleaner* (73) Subsoil* (91) Hot Water—Kitchen Sink**(21) (–ve coeff.) Hot Water—Running Kitchen Sink* (20) (–ve coeff.)
Children	Topsoil*** (225) Subsoil** (180) Paint—Accessible Surfaces* (760) (—ve coeff.) S.T. Dust from Vacuum Cleaner* (121) Plaster Accessible* (143)
Male Adults	Kettle Water*** (4) L.T. Dust—Inaccessible** (113) Paint—Accessible Surfaces* (156) Subsoil* (49) Cold Water—Running Laundry Tub* (29) (–ve coeff.)
Female Adults	Cold Water—Laundry Tub** (67)
Adults	Paint—Floor* (44) Subsoil* (105) Cold Water Laundry Tub* (111) S.T. Dust—Windowsill* (29) (–ve coeff.)

TABLE 8.18
SUMMARY OF RESULTS OF REGRESSION ANALYSIS
OF BLOOD LEAD LEVEL VS. ENVIRONMENTAL RESULTS BY AREA

Group	Area		
	Toronto Refiners	Canada Metal	Prestolite
Male Children	L.T. Dust—Inaccessible ***	Plaster—Accessible*	Cold Water—Running from Kitchen Sink*
	L.T. Dust—Floor*		
	Subsoil* (-ve coeff.)		
Female Children	L.T. Dust—Inaccessible ***	Cold Water—Running from Kitchen Sink* (-ve coefficient)	S.T. Dust from Floor***
	L.T. Dust—Floor*		Topsoil**
	S.T. Dust—Vacuum Cleaner*		Hot Water—Kitchen Sink** (-ve coeff.)
	Paint—Accessible Surfaces*		Plaster-Access.*
	Paint—Inaccessible Surfaces*		Hot Water—Running from Kitchen Sink* (-ve coeff.)
Children	L.T. Dust—Inaccess.***	Cold Water—Running from Kitchen Sink** (-ve coefficient)	Cold Water—Running from Kitchen Sink**
	L.T. Dust—Floor**		S.T. Dust from Floor*
	Paint—Accessible Surfaces**	Plaster—Access.*	
	Paint—Inaccessible Surfaces*		
	S.T. Dust—Vacuum Cleaner*		
	Topsoil*		
Male Adults	S.T. Dust—Vacuum Cleaner* (-ve coeff.)	Paint—Accessible Surfaces**	Kettle Water***
		Cold Water—Running from Laundry Tub** (-ve coeff.)	
		L.T. Dust—Inaccess.*	
Female Adults	S.T. Dust—Vacuum Cleaner*	Cold Water—Laundry Tub**	
	L.T. Dust—Inaccess.*	Cold Water—Bathroom** (-ve coeff.)	
		Cold Water—Running from Bathroom* (-ve coefficient)	
Adults	L.T. Dust—Inaccess.*	Cold Water—Laundry Tub**	Paint—Floor*
		Paint—Accessible Surfaces*	
		L.T. Dust—Floor* (-ve coeff.)	
		Cold Water—Running from Laundry Tub* (-ve coeff.)	
		L.T. Dust—Miscellaneous Access.* (-ve coeff.)	

8.4 Analysis of Sample Results and Their Relationship to Distance from the Plants

As mentioned in Chapter 6 in the discussion of relationships between blood lead levels and distance from the lead plants, one of the confounding factors in that analysis may have been the distribution of other potential sources of lead within the plant areas. For example, the significant decline in blood lead levels as distance from the plants increases might be related to paint rather than to the lead plant if, by some chance, the paint in homes nearer the plants had a higher lead content.

To investigate this possibility, we performed analyses to determine the relationship between the sample results and their distance from the plants.

Tables 8.19-8.21 show the regression coefficients and their significance.

As can be seen, only soil leads in the CM area decline in a statistically significant manner with increased distance from the plant. The only statistically significant relationship between the sample results and distance is for paint from inaccessible surfaces in the Pr area which shows a positive regression. This indicates that paint lead levels increase as distance from the plant increases. It is therefore clear that the significant regression between blood lead levels and distance found in Chapter 6 are not due to a fortuitous distribution of the potential lead sources sampled in this survey.

TABLE 8.19
RESULTS OF REGRESSION ANALYSIS OF HOUSEHOLD SAMPLE LEAD LEVELS AND DISTANCE FROM THE CENTROID OF THE PLANT
Toronto Refiners

Type of Sample	Regression Coefficient	Standard Error	Signi-ficance	Number of Cases
Paint—Accessible Surfaces	–21.67	24.50		15
Paint—Inaccessible Surfaces	–67.56	224.93		14
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner	– 8.08	4.54		5
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	1.00	21.91		8
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	– 4.95	4.13		9
Wallpaper				
Plaster—Accessible				
Topsoil	–15.42	11.10		9
Subsoil	– 5.27	6.05		9
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	0.00003	0.00003		9
Cold Water—Bathroom	0.00033	0.00024		3
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

TABLE 8.20
RESULTS OF REGRESSION ANALYSIS OF HOUSEHOLD SAMPLE LEAD LEVELS AND DISTANCE FROM THE CENTROID OF THE PLANT
Canada Metal

Type of Sample	Regression Coefficient	Standard Error	Signi-ficance	Number of Cases
Paint—Accessible Surfaces	16.49	11.43		138
Paint—Inaccessible Surfaces	37.57	37.69		77
Paint—From Floor	–122.70	76.99		12
S.T. Dust—Miscellaneous Accessible	–3.43	3.48		6
S.T. Dust—From Floor	4.42	16.63		48
S.T. Dust—From Windowsill	–0.84	7.08		9
S.T. Dust—From Vacuum Cleaner	–0.99	2.32		22
L.T. Dust—Miscellaneous Accessible	–3.04	3.69		15
L.T. Dust—From Floor	1.34	5.29		82
L.T. Dust—From Windowsill	–7.94	9.83		56
L.T. Dust—Inaccessible	0.89	1.71		100
Wallpaper	–2.61	4.10		15
Plaster—Accessible	0.08	7.67		26
Topsoil	–2.16	0.38	***	61
Subsoil	–2.86	0.56	***	42
Cold Water—Laundry Tub	0.00001	0.00001		54
Cold Water—Kitchen Sink	0.00002	0.00001		76
Cold Water—Bathroom	0.00016	0.00010		9
Cold Water—Running from Laundry Tub	–0.0	0.00003		32
Cold Water—Running from Kitchen Sink	0.00001	0.00002		64
Cold Water—Running from Bathroom	0.0	0.00002		5
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

TABLE 8.21
RESULTS OF REGRESSION ANALYSIS OF HOUSEHOLD SAMPLE LEAD LEVELS AND DISTANCE FROM THE CENTROID OF THE PLANT

Prestolite

Type of Sample	Regression Coefficient	Standard Error	Signi-ficance	Number of Cases
Paint—Accessible Surfaces	21.89	16.09		108
Paint—Inaccessible Surfaces	76.78	33.81	*	32
Paint—From Floor	138.43	102.62		12
S.T. Dust—Miscellaneous Accessible	2.11	1.46		21
S.T. Dust—From Floor	–15.64	19.29		34
S.T. Dust—From Windowsill	21.53	19.96		10
S.T. Dust—From Vacuum Cleaner	–0.06	0.40		30
L.T. Dust—Miscellaneous Accessible	0.56	3.16		7
L.T. Dust—From Floor	–0.13	1.76		17
L.T. Dust—From Windowsill	–5.38	2.52		9
L.T. Dust—Inaccessible	–0.65	1.78		93
Wallpaper				
Plaster—Accessible	2.03	4.74		10
Topsoil	–0.73	0.64		27
Subsoil	–0.27	0.45		23
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	0.0	0.00001		107
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	0.0	0.349		106
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	0.0	0.00000		25
Hot Water—Running from Kitchen Sink	–0.0	0.00000		24
Kettle Water	–0.00010	–0.00020		7

CHAPTER 9

DISCUSSION OF RESULTS AND COMMENTS ON PATHWAYS FOR LEAD INTAKE BY HUMANS

The objective of the Task Force was to determine the potential sources of lead contamination in the study areas and the pathways by which this contamination entered the human body.

Lead is available in the vicinity of the three lead plants from a variety of sources. These include suspended airborne lead, lead in dustfall, lead in soil, and lead from non-industrial sources such as paint, water supply and cooking utensils. It has already been determined (Working Group Report, 1974) that in the vicinity of the three lead plants, the plants themselves were significant sources of environmental lead contamination. The level of contamination declines as distance from the plant increases.

In the present study, the blood lead levels of people living near the lead plants showed a similar pattern, being highest near the plant and declining with distance. The proportion of high ($\geqslant$40 mcg) cases in the plant areas was 3.2% compared to only 0.3% in the Control Area.

When 200 metre wide concentric rings about the centroids of the plants were considered, the percent of high cases was significantly higher in the nearest ring than in the furthest at both TRS and CM. Similar results were obtained through the examination of the geometric means in the rings. In the distance ring series the geometric means decreased with increasing distance from the plants, significantly so, for all the children groups with one exception and for the male adults in the CM area. Blood lead levels in the Control Area were significantly lower than in the CM area for every age and sex group, and for many of the groups in the TRS and Pr areas.

Multiple regression analysis relating blood lead levels to distance and age revealed significantly declining blood lead levels with increasing distance for children in all three plant areas and for adults at CM.

Since soil lead contamination has previously been found to decrease with distance it was natural to suspect that blood lead and soil lead would correlate well with each other. Using five increasing soil lead level ranges the percent of individuals with high blood lead levels increased as soil lead level range increased for both children groups and male adults. The geometric mean blood lead levels were significantly higher for people living in areas where the soil lead level exceeded 1,000 ppm than for people who lived in areas where the soil lead levels were in the 0-599 range. This was true in all age/sex groups when all three plant areas were combined.

Multiple regression analysis performed on blood lead versus estimated soil lead and age indicated that blood lead levels increased with increasing soil lead for all age/sex groups but results were statistically significant only for the male children in all areas. At CM, however, female children and male adult groups also provided significant results.

Current emissions of airborne and dustfall lead must be considered as factors which could account for the finding that blood lead levels decline as the distance from the plant increases. Such a relationship between airborne and dustfall lead and blood lead levels could come about through the following mechanisms. The first is the direct inhalation and absorption of the respirable portion of the airborne lead which is suspended in the air. The second is the absorption of lead after it has fallen to the ground and has either contaminated materials which later gain access to the mouth or has been re-entrained and inhaled due to disturbances of the lead containing dust. This dustfall represents the current contamination from the lead plants. Over a period of time the dustfall becomes incorporated into the soil and contributes to the total historical lead content of the soil. That this is the mechanism by which the soil lead gradients around the lead plants are produced is supported by the finding that the level of lead in dustfall also declines with distance from the plant, (Working Group Report, 1974) and by the high correlation between lead in dustfall and lead in soil samples where the two samples are taken from locations in close proximity.

Because suspended lead as measured by high volume samplers, and dustfall as measured by dustfall jars and soil lead all decrease as the distance from the plant increases the relative importance of these three pathways for human lead absorption is difficult to measure, but for the following reasons suspended lead would seem to be a relatively less important pathway than settled lead dust or soil lead in producing elevated blood lead levels around the Toronto plants.

The first reason is that the elevated blood lead levels are unevenly distributed. If inhaled lead was the primary pathway, a more uniform general elevation of blood lead levels might be expected around the plants paralleling the fairly uniform distribution of suspended lead in the air around the plant and the fairly steep decline in suspended lead levels as distance from the plant increases. In fact, the elevated blood lead values, while occurring with greater frequency close to the plants, are irregular in their distribution. High values are found in persons living in the same house or next door to people

with average or low values. This finding is more consistent with the operation of personal factors such as hand to mouth activity of children, or hygiene factors such as poor housekeeping, than it would be with inhalation of air containing essentially the same concentration of lead by everyone in a house or a group of houses.

The second reason is that the adult women do not show significant blood lead gradients with distance from the plant. If inhaled lead were the main source of elevated blood lead levels it would be expected to produce blood lead gradients decreasing with distance from the plant in all resident groups. This should be particularly true for adult women who could be expected to spend a greater proportion of their time in the area and in the home. The lack of such a finding in adult women and the finding of such a gradient in children suggests that other factors are more important in producing the gradient than the inhalation of airborne lead.

The third reason is that over the range of air lead levels measured as long-term averages no statistically significant effect on blood lead levels has so far been demonstrated in population studies. Although under experimental conditions suspended lead levels in the range from two to 10 micrograms per cubic metre have been found to alter the blood lead level of human volunteers, urban residents measured under field conditions showed no statistically significant change in blood lead, over a range of air lead values extending up to about 4 mcg per cubic metre measured as an average over weeks or months. Therefore, since average suspended lead levels around the lead plants rarely exceeded 4 mcg measured at stations in residential areas it seems unlikely that a discernible effect of airborne lead levels upon blood lead levels could be detected from the data available.

Since major studies of childhood lead poisoning in the U.S. have shown that the usual source of lead was found in the home (e.g. in paint, toys, etc.) it was important to examine these sources in Toronto.

In the study of high, match and control houses there were no significant regressions found between distance and identifiable non-industrial sources of lead such as paint, water supply and cooking utensils, indicating that these potential sources do not become more plentiful as one moves closer to the plants (*Section 8.4*). The very strong association seen between blood lead concentrations and distance from the plants can therefore not be attributed to a coincidental gradient of non-industrial sources or differences in housekeeping patterns.

At the same time, it must be acknowledged that non-industrial sources may well account for some of the elevation in blood lead levels seen in high cases. The high houses in the CM area showed a higher average concentration of lead in accessible paint than did the match houses, but were not higher than the control houses. It should be noted that in the Pr area the match houses had higher levels of lead in accessible paint than did the high houses. Peeling or chipping of paint was also seen more often in high houses than match houses in the CM area but not in the Pr area. Electric kettles were used more frequently in high than matched houses in both the CM and Pr areas but the differences are not statistically significant. Lead plumbing was more common in the high than match houses in the Pr area. However, the latter two conclusions are based on very few responses.

Other comparisons between high, match and Control Area houses show few consistent or convincing differences in the availability of lead. This is not altogether surprising since the match houses were, by definition, very similar in age and structure to the high houses, and all four areas were of similar age and socio-economic standing. Furthermore, factors that might be related to a geographical point source such as lead concentration in airborne dust or soil would likely be similar in a high house and its match neighbor. Factors that vary geographically could therefore only be expected to show up as gradients within each area (as previously discussed) or in comparisons with the Control Area.

One noteworthy feature of these data in comparison with reported experience in the older urban neighborhoods of the United States is that paint appears to be a relatively unimportant source of lead in the City of Toronto. Not only was the lead content of accessible paint surfaces relatively low (less than 4%—or 40,000 ppm—compared to typical concentrations of 5-40%—or 50,000-400,000 ppm—reported from U.S. city centres) but relatively few houses showed peeling paint or flaking plaster, unlike the "ghetto" conditions reported in some American cities.

Water analyses indicate that waterborne lead is not likely to be making a significant contribution to elevated blood lead levels in the areas tested. Mean values were all well below the recommended upper limit of 0.05 ppm.

Although house dust samples were relatively few in some areas and for some categories, it appears unlikely from these data that house dust is an important source of lead in most of the high cases. Even when windowsill dust samples are kept separate (since they were high in lead content in all areas), mean lead levels in both high and match houses tend to be no higher than in the Control Area. Where comparisons between high, match and control houses were possible, concentrations of lead in dust were only significantly different in two instances (but in opposite directions) and there was little evidence of consistent or meaningful trends.

Although, unfortunately, no soil samples were taken from individual houses as part of the Toronto Board of Health "epidemiological" survey in the Control Area, figures obtained previously by the Phytotoxicology Section of the Ministry of the Environment give an average lead concentration in this area of 480 ppm in topsoil and 458 ppm in subsoil. Mean soil concentration therefore appears to be a "geographical" factor that is markedly different in the plant areas compared to the Control Area.

For lead to be absorbed it must not only be present in the environment, but must also be transferred from the environment to the gastrointestinal tract, or (in the case of suspended particulate) the lungs.

This transfer process may be affected by a number of factors, among them personal habits and behavior. These may have little effect on the availability of certain potential sources such as food or water contaminated by containers or plumbing but may be of great importance in others, such as paint, dust or soil. Thus inade-

quate maintenance might lead to flaking paint and plaster, careless housekeeping might result in the accumulation of excess quantities of dust, and poor personal hygiene might be associated with a failure to wash hands before eating or preparing food. It is, therefore, of some interest that although the differences were not always statistically significant, the percentage of homes rated 'fair to poor' in housekeeping and hygiene tended to be higher for the high than the match or control houses.

In addition, there is the factor of age, with young children tending to explore their environment, by chewing and sucking on their fingers, toys and other interesting objects. This might be expected to accentuate the effect of a dusty or ill-maintained environment, but it could also result in elevated blood lead levels (e.g. from heavily contaminated soil or exterior dust) in spite of an otherwise clean and well-maintained home. However, while in the case of children it is not difficult to postulate mechanisms by which soil lead could gain access to the body, it is harder to account for the significant relationship between blood lead levels and soil lead levels which was found for adults in some areas.

APPENDIX 1A

RECOMMENDATIONS OF THE WORKING GROUP ON LEAD

1. All lead-bearing materials with a potential for contamination of the environment be shipped in closed containers or an equivalent method be used to prevent loss of lead to the environment.

2. The unloading, movement and storage of such lead-bearing materials on the property of lead processing companies be conducted in such a manner that the material is totally enclosed and losses to the environment are prevented.

3. The handling of such lead-bearing materials be conducted in enclosed buildings or by the use of enclosed conveying systems to prevent loss of lead or lead compounds to the outside.

4. The processing of lead-bearing materials be controlled at source using best available technology to limit emissions to meet the proposed air quality standards and criteria of the Ontario Ministry of the Environment, which should be promulgated as soon as possible. The standard is 10 ug/m^3/30 min. average and the criteria are 5 ug/m^3/24 hour average and 2 ug/m^3/30 day geometric mean.

5. Backup control equipment or devices must be provided so that control to meet the standard is maintained in the event of primary control failure.

6. Emissions of lead and lead compounds to the environment be continuously monitored by the companies to the satisfaction of the Ontario Ministry of the Environment and the records be made available to the Ministry on request.

7. Regular programs for maintenance of all control equipment and for a high standard of housekeeping on company property be implemented by lead processing companies to the satisfaction of the appropriate government authorities.

8. Regular inspection of the in-plant conditions, equipment and recording devices be maintained by the appropriate government authorities.

9. Programs for surveillance of community blood lead levels and related home environment be continued by public health authorities.

10. The lead levels in the air, soil, dust and vegetation in the vicinity of lead sources continue to be monitored by government authorities.

11. Cleanup of soil, street dirt and house dust be carried out in the contaminated areas contiguous to the lead plants. These contaminated areas to be designated as the zones in which the lead content of the top two inches of soil exceeds 1,000 parts per million. Priority should be given to schoolgrounds and parks.

12. Provision should be made to assist relocation of families with children from the vicinity of lead sources upon medical advice.

13. Cleanup of residual contamination be required upon relocation or discontinuation of a lead processing operation resulting in a different land usage of the site.

14. The Working Group also recognizes that the classical causes of high lead absorption in individuals due to sources such as domestic lead paint, lead waterpipes, lead from improperly glazed ceramics, etc., are present in Ontario and steps should be taken for their elimination by the appropriate authorities.

APPENDIX 1B

GENERAL TERMS OF REFERENCE LEAD DATA ANALYSIS TASK FORCE APRIL 7, 1975

Executive Summary

The Environmental Hearing Board has agreed to adjourn the Lead Hearings shortly to permit the completion of the computer analysis of lead data. A task force is proposed to complete the job and report in 3-4 months. The task force will require not only a commitment of manpower and resources but the full support of all parties at the hearings in order to complete this difficult assignment.

Introduction

Counsel for all major participants before the Environmental Hearing Board have expressed a desire to have available the results of the epidemiological survey conducted by the City of Toronto Department of Public Health. To accommodate this, the Environmental Hearing Board has expressed a willingness to adjourn the hearings without hearing medical testimony and to reconvene when the report of this survey becomes available.

Current Status of Data Analysis

The data analysis system is being developed by the Ministry of Government Services under the direction of the Working Group on Lead. The raw data have, in large part, been coded, key punched and transferred to computerized files. *The file data require checking and verification,* a task requiring a close working relationship with the City of Toronto personnel.

The Task Force

A formalized task force was proposed, including representatives from the Working Group on Lead, the City of Toronto Department of Public Health, and the University of Toronto. Technical Advisors to the Hearing Board would be welcomed. Designates from the major participants will be invited to sit with the task force as observers, to be fully informed of the nature of the data and the statistical analysis. Every reasonable attempt will be made to accommodate the wishes of these representatives in the performance of analyses, but control will remain with the task force.

Objective of the Task Force

The main objective of the task force is to provide a report of the relationship between the blood lead levels and environmental data in an attempt to determine the pathways by which environmental lead reaches the individual, using the data from the surveys conducted in the City of Toronto.

Regular meetings on an 'as required' basis would be held. This would require that the priority of Group members be to the task force and that, as far as feasible, they be available at short notice.

A written record of each meeting and final instructions would be kept. (Not necessarily in the form of detailed minutes).

Project Budget

Apart from the manpower and staff commitments outlined in this appendix, there will be need for additional budget for both data processing and payment of salaries of contract staff as shown. This budget will be part of a submission to Management Board of Cabinet.

M.G.S. Computer Services	$10,000
M.G.S. Staff Services	32,000
Univ. of Tor. Biostatistician	7,000
City of Tor. Computer Staff	10,000
Secretarial services	5,000
Technical writer	5,000
Miscellaneous & contingency	5,000
Sub-total	$74,000
Printing	1,000
Total Estimated Cost	$75,000

Commitment to the Project

Even given the commitment of manpower and resources outlined so far, unless the support, cooperation and backing of the Ministry of the Environment, the Ministry of Health, the Ministry of Government Services, the City of Toronto Board of Health and Department of Public Health is forthcoming, the project will in all likelihood fail or drag on interminably to an indefinite conclusion. The terms of reference of the task force will be available for comment by all parties.

Project Timing

In a complex problem such as the examination of the relationship of lead in the environment and blood lead levels, the time required is difficult to predict in any meaningful way. It is of little use to proceed with statistical analyses until the data base has been verified.

An impossible situation will occur if additional epidemiological data are trickling in whilst the analyses are being attempted.

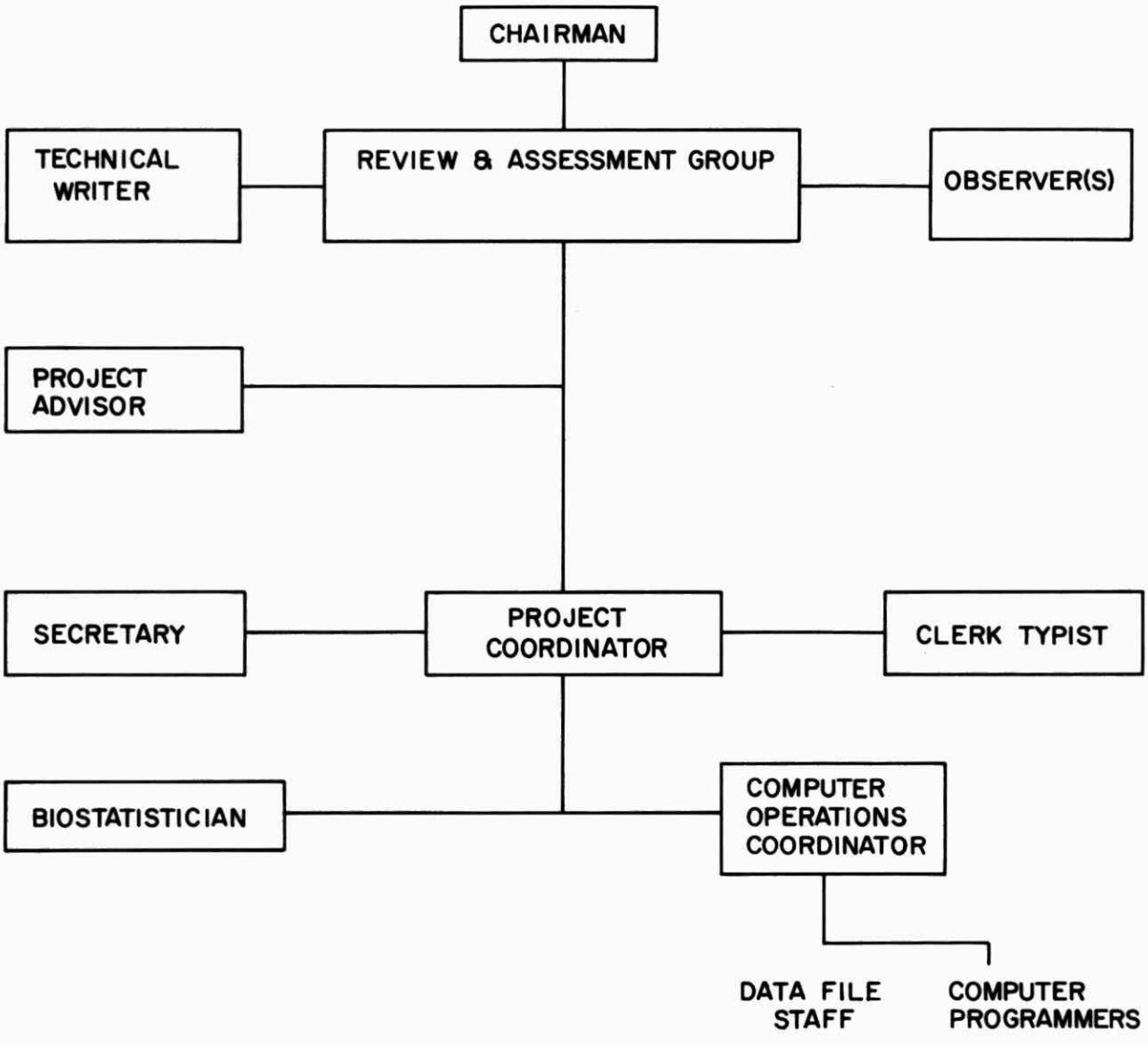
A target date has been established as the end of July, 1975.

TASK FORCE STAFFING AND FUNCTIONS

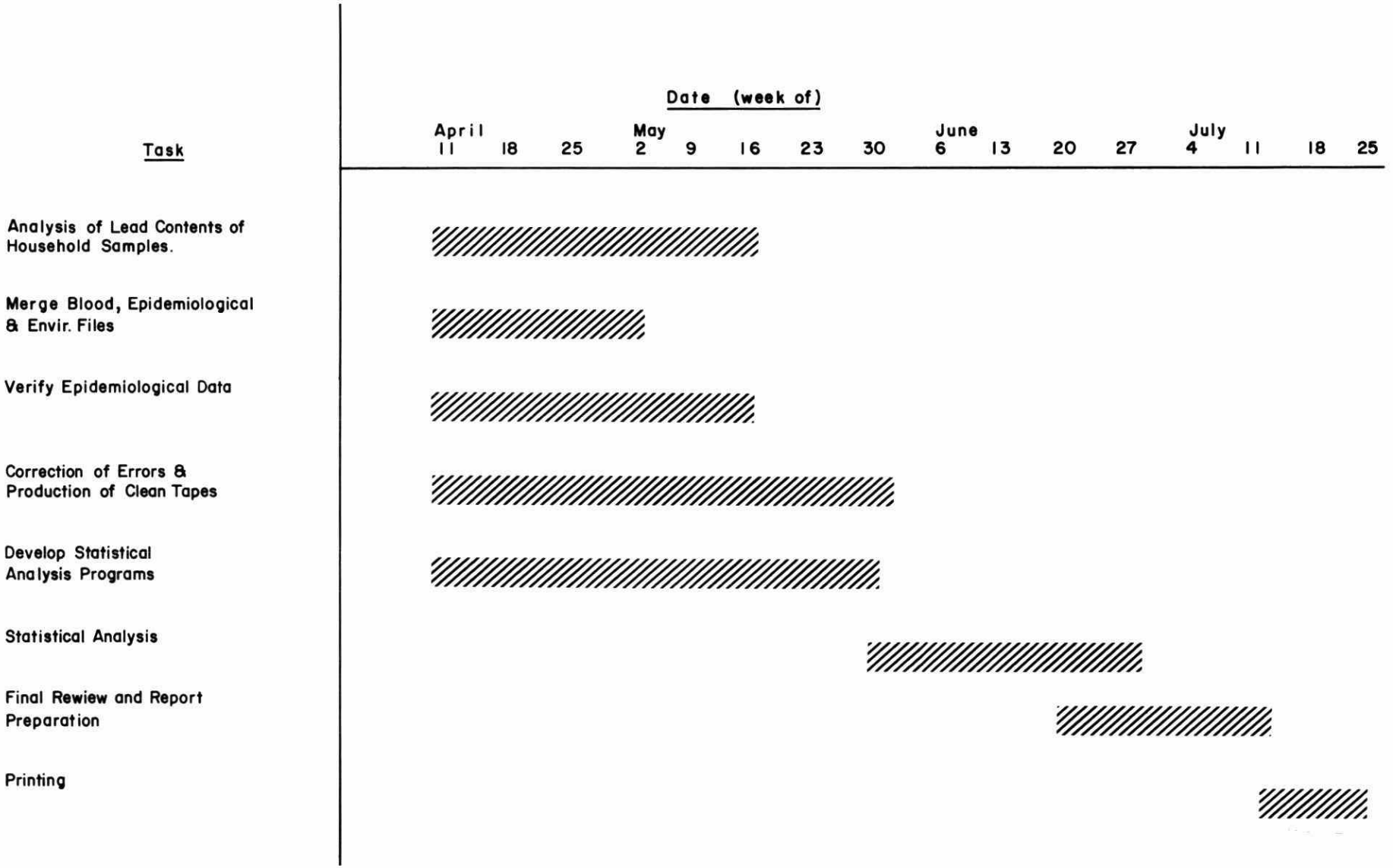
POSITION	FUNCTION	DESIGNATE
Task Force Chairman	To direct the task force. Authority to cut red tape and obtain priorities and commitments. To chair review meetings.	Dr. G.K. Martin
Review and Assessment Group	To review and direct the data analyses to meet the objectives of the task force. To review and direct the preparation of the final report. Responsible for the technical content of the report. Dr. Moss's participation limited to matters concerned with sampling program.	*Physicians:* Dr. G.J. Stopps Dr. T. Anderson Dr. G.W.O. Moss (Dr. J. Mitchell) *Environmental experts:* Dr. S. Linzon Mr. L. Shenfeld
Observer(s)	To examine the data base and the statistical analysis, and to make suggestions.	*Designate(s) of major participants*
Advisor	To review with the Project Coordinator and advise on instructions received from the Review & Assessment Group. To review and advise on the report from the Project Coordinator to the Review & Assessment Group.	Dr. R. Higgin *Ministry of Energy*
Task Force Coordinator Location: Office Space in 2 Bloor St. West	To coordinate the activities of the Operations Group, expedite the analysis and interface between the Review & Assessment & Operations Group.	Mr. D.J. Ogner *Chief, Air Quality Assessment*
Biostatistician Location: Office Space in 2 Bloor St. West	To advise the Review Group on the best statistical approach(es) to the problem. To have principal responsibility for specifying the statistical runs to be performed. To verify these runs and to assist the task force coordinator in the preparation of reports. To assist in a check of the data files against input records.	Mrs. A. Csima *University of Toronto School of Hygiene*

Computer Operations Coordinator (full time) Location: 2 Bloor St. W.	To be responsible for the processing and computer analysis of the data. To supervise the writing of programs, the preparation and submission of computer jobs. To resolve problems with programs, and data files, and to produce hard copy printouts and graphs in a format suitable for presentation to the Review Group.	Mr. B. Izatt *Ministry of Government Services*
Data File Staff	On a priority basis, to be responsible for providing computer records in a suitable format of the data required by the task force. To create, maintain and update their particular data files. To resolve problems with (and to check and validate) the data on file to the satisfaction of the task force.	Mr. C. Gregory and Mr. H. Heise, *City of Toronto (blood lead and epidemiological files)*
Computer Programmers	To develop and write programs, to analyze the data, and to modify or extend existing statistical programs as required. To maintain and document the programs. To prepare and submit computer jobs as required.	Mr. K. Lauw Miss S. Phang Mr. B. Wedgwood
1 Clerk Typist	Clerk Typist to maintain typed records of computer runs and statistical analysis performed. To type reports by the Operations Group and assist in general duties.	Assigned to 2 Bloor St. W.
1 Secretary	To assist the task force Coordinator to keep records and minutes. To assist in the preparation of reports, arrange meetings and type final report.	Assigned to 2 Bloor St. W.
1 Technical Writer	To write a scientific report detailing the study and the results, based on the data provided. To attend review meetings. To prepare a final report under direction of Review & Assessment Group.	To be arranged

TASK FORCE ORGANIZATION



LEAD DATA ANALYSES PROJECT SCHEDULE



APPENDIX 2A

LIST OF MICRO AND MACRO COMPARATIVE BLOOD TESTS

Micro	Macro	Micro	Macro	Micro	Macro
26.5	28.0	19.5	33.0	16.0	20.0
15.0	23.0	21.0	12.0	8.0	4.0
26.0	23.0	6.5	10.0	15.5	11.0
18.5	22.0	14.0	23.0	12.5	9.0
13.5	12.0	17.0	11.0	8.0	8.0
16.0	8.0	11.5	22.0	13.5	10.0
23.0	9.0	25.5	19.0	11.0	8.0
14.0	12.0	15.5	12.0	13.5	12.0
23.5	6.0	21.5	21.0	12.5	12.0
17.0	17.0	26.0	22.0	20.5	24.0
33.0	22.0	12.0	17.0	9.0	4.0
23.0	13.0	26.0	21.0	12.5	8.0
12.5	10.0	14.5	13.0	13.5	20.0
10.5	7.0	22.0	25.0	5.5	8.0
24.5	23.0	22.5	14.0	14.0	9.0
21.0	13.0	16.5	15.0	6.5	15.0
10.5	10.0	26.5	21.0	17.5	19.0
12.5	14.0	26.0	10.0	23.5	23.0
27.0	19.0	18.5	13.0	22.0	17.0
10.5	13.0	24.0	10.0	16.0	17.0
12.5	12.0	12.5	20.0	21.5	11.0
14.0	9.0	20.0	22.0	44.5	14.0
18.5	18.0	11.0	11.0	16.5	14.0
13.0	4.0	16.5	20.0	10.5	16.0
26.0	4.0	14.0	13.0	42.0	26.0
47.0	27.0	13.0	9.0	38.0	22.0
27.0	19.0	7.0	12.0	31.0	20.0
19.0	10.0	21.0	16.0	12.0	21.0
21.5	10.0	17.0	21.0	11.5	22.0
26.0	17.0	20.0	22.0	12.5	20.0
22.0	21.0	17.0	12.0	11.0	9.0
22.0	12.0	20.0	21.0	17.0	19.0
18.0	25.0	8.5	10.0	5.0	4.0
22.5	13.0	32.5	27.0	10.0	24.0
14.0	17.0	15.5	12.0	20.5	8.0
20.5	27.0	21.5	8.0	11.5	11.0
24.5	24.0	22.5	12.0	14.0	9.0
20.5	8.0	17.0	12.0	27.0	18.0
54.0	15.0	28.0	20.0	20.5	13.0
32.0	26.0	8.5	12.0	18.5	21.0
29.0	17.0	15.5	14.0	25.0	19.0
17.0	19.0	28.0	13.0	8.0	4.0
18.5	22.0	12.5	11.0	21.0	23.0
24.5	17.0	20.0	13.0	14.5	17.0
26.5	22.0	21.0	7.0	17.0	21.0
11.5	9.0	11.5	5.0	9.0	4.0
15.5	17.0	12.5	12.0	24.0	22.0
26.0	30.0	14.5	14.0	16.0	23.0
30.0	22.0	18.5	15.0	16.5	8.0
20.5	22.0	35.5	23.0	18.0	20.0
15.0	9.0	43.0	27.0	11.0	16.0
19.0	14.0	13.0	9.0	19.0	12.0
12.0	12.0	15.0	10.0	20.0	14.0
15.0	15.0	12.5	16.0	21.5	23.0
30.5	28.0	11.0	5.0	25.0	30.0
14.5	15.0	39.5	16.0	21.5	16.0
29.5	20.0	20.0	9.0	23.5	4.0
16.0	15.0	21.0	10.0	27.5	22.0

APPENDIX 2B

PARENTAL CONSENT LETTERS

Dear Parent:

You have probably heard about the higher than usual levels of lead in this area as published in a report by the Province of Ontario Ministry of Environment. The City of Toronto Department of Public Health, in cooperation with the area residents, is undertaking a survey of blood lead of all the children attending the Bruce Public School. We would very much appreciate your consent to take a few drops of blood from a fingerprick of your child to analyse for lead. The results will be mailed to you.

JWM/LL

DPH3491

Deputy Medical Officer of Health.

BRUCE PUBLIC SCHOOL
51 Larchmount Avenue
Toronto, Ontario
M4M 2Y6

Because of a growing concern in our area over a possible health hazard from excessive amounts of lead reported to be in the soil in this neighbourhood, arrangements have been made to provide free blood lead level tests. This service will be provided at our school on Monday, October 15th during the following hours -

9 a.m. - 12 noon; 2 p.m. - 6 p.m.; 7 p.m. - 9 p.m.

and all area residents, from pre-schoolers to adults, are encouraged to take advantage of it.

Our school children will be tested during school hours if a signed consent form is returned from home on or by Monday.

John R. B. Adams,
Principal.

JRBA:cc

Bruce Public School,
51 Larchmount Avenue,
Toronto, Ontario.

Dear Parent:

There has been a recent study of the area close to Bruce School which indicates that there appears to be a higher than usual content of lead in the soil.

The City of Toronto, Department of Public Health, in co-operation with the area residents, would like to test a finger prick sample of blood from the children attending Bruce School, to determine the presence of lead in the blood.

We would very much appreciate your consent to take a few drops of blood from a finger prick of your child to analyze for lead.

The results will be mailed to you.

This testing will take place at Bruce School on Monday, October 15, from:

9:00 a.m. to 12:00 p.m.
2:00 p.m. to 6:00 p.m.
7:00 p.m. to 9:00 p.m.

Parents and preschoolers who reside in the area are also welcome to be tested at the above times.

Please return attached consent form to Bruce School by Monday, October 15, at 9:00 a.m.

Sincerely,

Dr. J. Mitchell,
Deputy Medical Officer of Health,

John R. B. Adams, Principal.

(Message translated in Chinese for
Chinese speaking families)

APPENDIX 2C
RESIDENTS' ASSOCIATION FLYER

CLINICS

PLACE	DATE	HOURS
St. Mary of the Angels School	Thursday, January 10 Thursday, January 24	9 a.m. - 12, 2 - 5 p.m. 7 p.m. - 9 p.m.
Pauline Public School	Wednesday, January 16	9 a.m. - 12, 2 - 5 p.m. 7 p.m. - 9 p.m.
St. Anthony's School	Thursday, January 31	9 a.m. - 12, 2 - 5 p.m. 7 p.m. - 9 p.m.
	Thursday, February 7	9 a.m. - 12, 2 - 5 p.m. 7 p.m. - 9 p.m.
St. Sebastian Separate School	Thursday, February 14	9 a.m. - 12, 2 - 5 p.m. 7 p.m. - 9 p.m.

Any resident or employee in the area may be tested at any of the clinics at any time.

Please return the consent form to the school.

The Board of Health would also like to take a small sample of hair to determine past lead levels, as well as the presence of other metals. However, it is the blood test which is the most important, and a hair sample does not have to be taken.

This information is published by the

Volunteer Residents Committee

For more information call:

Irene Harris or Lynn Cox: 531-6322

Mary Cortese: 531-2252

Mrs. Greer: 531-5494

Mrs. Chipman: 536-5233

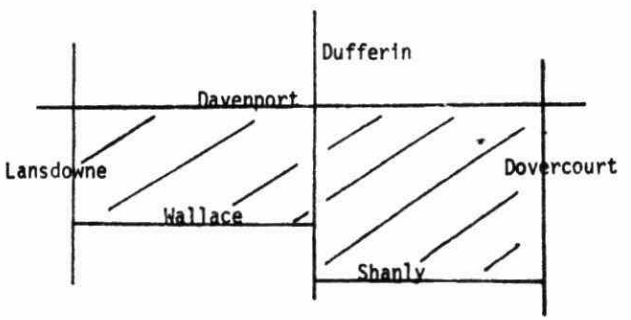
BLOOD TESTING PROGRAM

As a precautionary measure, the Toronto Board of Health will be conducting blood tests of residents in the area near the Prestolite factory. Tests conducted near two other lead producing factories show that some residents have abnormally high blood lead levels.

Studies done by the Provincial Air Management Branch and the University of Toronto show that although lead levels in the foliage near the Prestolite factory are ten times the Metro average, they are not nearly so high as the levels near the other two factories. Although there seems to be cause for concern, there is not cause for alarm at this time.

One reason these tests are necessary is because although one of Prestolite's filtering systems was not in operation for three months this summer, the Provincial Air Management Branch allowed the factory to continue operating.

This is the testing area:



WHO DOES THE TEST? The test is done by a medical doctor, with the assistance of a Public Health nurse.

HOW IS IT DONE? The blood samples are taken from a fingerprick, after the finger has been washed and coated with a protective spray. Two samples are taken.

WHERE DOES THE SAMPLE GO? The sample is sent to a lab in Massachusetts for analysis. It takes three weeks before the results are returned to Toronto.

WHO GETS THE RESULTS? The results go to the Board of Health. The Board of Health will notify each person of the results of his test, by letter.

WHAT DO THEY MEAN? Blood lead levels are measured in micrograms per 100 millilitres of blood. You will receive an analysis of each sample, and an average of both.

People in rural areas show from 5 to 15 micrograms of lead per 100 millilitres of blood.
People in cities show from 5 to 30 micrograms of lead per 100 millilitres of blood.

If your tests show a reading of between 30 and 39 micrograms of lead, you will be advised to have a follow-up test within 2 to 4 months.
If your tests show a reading of between 40 and 69, you will be referred to a doctor at Sick Children's Hospital.
If tests show 70 micrograms of lead, you will be notified immediately.

CAN YOUR FAMILY DOCTOR DO THE TEST? Probably not. The analysis for lead is a very difficult one, and must be done in a laboratory. If your doctor has a contract with the Environmental Sciences Associates Lab in Massachusetts he could send a blood sample there. Ontario labs do not have facilities to do accurate testing.

Lead Poisoning...

Our bodies have different tolerances of different chemicals. In the case of lead, the average city dweller already has close to the maximum safe level. Additional sources of lead, such as from a nearby factory, can be dangerous to a person's health.

Because a child is growing, he is particularly susceptible to the effects of lead. In addition to breathing contaminated air, a child may eat soil containing lead, or chew on surfaces covered with a paint containing lead. However, most paints in Canada contain very little lead. But lead that one breathes, airborne lead, is a greater problem than lead that one eats. It is estimated that 50% of the lead we breathe is absorbed into the bloodstream, and only 10% of the lead we eat is absorbed into the bloodstream.

Children with high blood lead levels can suffer permanent damage to the brain and nervous system. The U.S. Environmental Protection Agency Health Effects Board reports that "symptoms of mild lead intoxication include loss of appetite, irritability, drowsiness, apathy and abdominal pain". Of course, many other factors also cause these kind of symptoms in children, and so it is difficult to diagnose lead poisoning on the basis of observation of behavior.

It is for this reason necessary to conduct the blood tests.

➔ Unborn children are vulnerable to lead, and pregnant women should be tested. It is also important that infants and pre-school children be tested. Please talk to your neighbours and encourage them to bring their young children to the clinic.

APPENDIX 2D

PROCEDURE FOR LEAD SAMPLING

Types of Surveys

1. *High lead level dwellings:* dwellings in which high lead levels were found in blood samples taken. These would be in the area immediately surrounding a source of contamination (e.g. Canada Metal).
2. *Match control:* dwellings in which no high lead levels were found in blood samples and were in close proximity to a high lead level dwelling.
3. *Random control:* a control area in which dwellings were chosen at random

General

A survey is usually performed by two inspectors. One inspector is responsible for collecting samples while the other is responsible for obtaining data for the lead questionnaire, labelling the samples and entering the proper codes on the data sheet.

The code for sampling is found in the *Guide for the Environmental Lead Survey Questionnaire.* Inspectors should be thoroughly familiar with this guide.

Certain information can be obtained before entry into the dwelling, e.g. street number and name, date, inspectors' names, type of building and construction of building. Also, mental note can be made of the condition of the building exterior.

Permission should be obtained from a responsible occupant or owner before survey and sampling. The nature of the survey, types of samples taken and methods of sampling is explained at this time.

On the whole, owners, occupants, etc., have been very co-operative with our Department and there have been very few refusals.

Occupant is interviewed and data is obtained for items 1 through 42 on the questionnaire by checking off the appropriate squares.

It should be noted that items 15, 23 and 26, which are conditions of building, housekeeping, and hygiene respectively, require an evaluation of the inspector following the guidelines set out in the guide.

The names, ages, sex and occupation of all occupants of the dwelling are obtained, and their sleeping quarters determined.

It is important that sections are filled in correctly as outlined in the guide.

COLLECTION OF BLOOD SAMPLES FOR LEAD ANALYSIS

(DEVELOPED FOR THE ANODIC STRIPPING VOLTAMETRY PROCEDURE)

EQUIPMENT

* 2 Lead-free Capillary Tubes
* 4 Tube Caps
* 1 2"X2" Sterile Gauze Sponge
* 1 Sterile Alcohol Pad

All equipment should be Lead-free and individually packaged. Open packages and remove caps just before each sampling.

PREPARATION OF CHILD

1. Wash hands with soap and water, using hand brush. Rinse well. Dry.
2. Grasp child's hand so that blood drawer's thumb is across top of child's fingers.
3. Hold child's hand so that his palm faces him. (See figure 1.)
4. Use child's middle or ring finger for sample.
5. Use alcohol sponge to scrub briskly an area on child's fingertip for 20 seconds.
6. Wipe scrubbed area once, using dry gauze.
7. Use lancet to stick finger slightly left of center as shown. (See figure 2.)
8. Use dry gauze to wipe off first drop of blood.

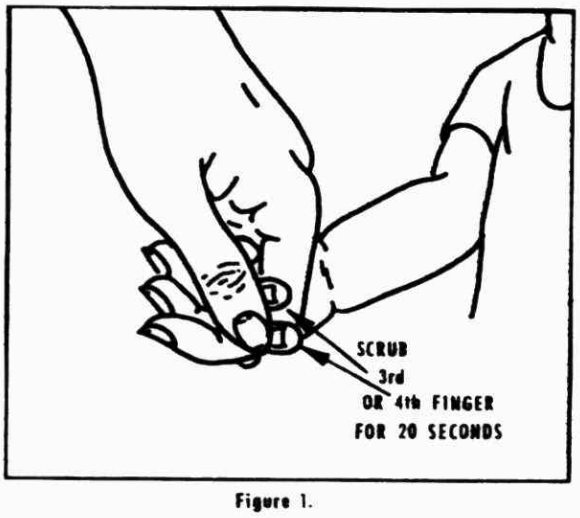


Figure 1.

COLLECTION OF BLOOD SAMPLES

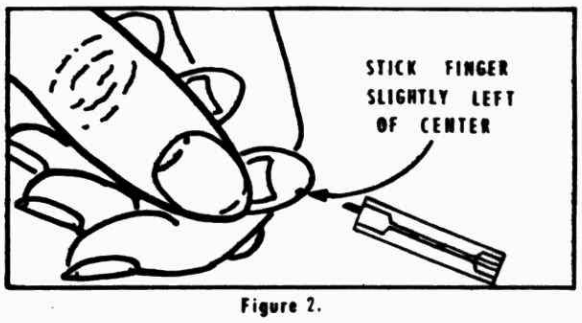


Figure 2.

1. Pick up capillary tube; hold at blue stripe.
2. Point collecting end slightly downward to avoid air bubbles. (See figure 3.)
3. Gently squeeze child's fingers toward fingertip and allow blood to enter tube to black line only. (See figure 3.)
   NO MORE, NO LESS, NO AIR ! !

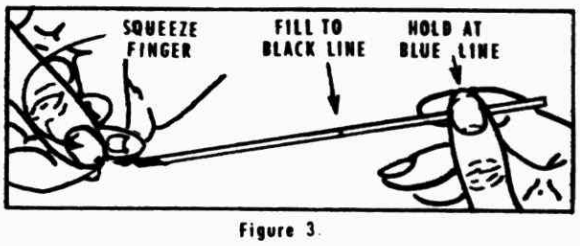


Figure 3.

4. After exact amount of blood is drawn, tip tube slightly upward allowing air to enter collecting end. (See figure 4.)

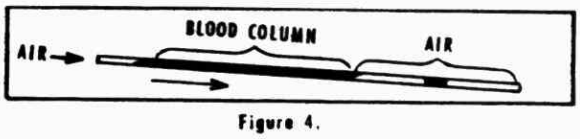


Figure 4.

5. Cap both ends. (See figure 5.)

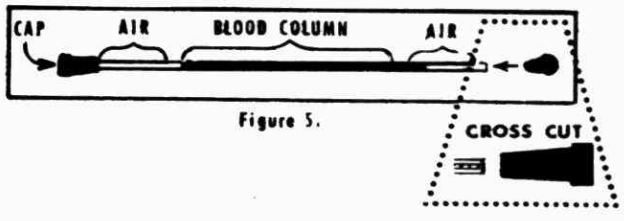


Figure 5.

6. Repeat steps 1 thru 5, using second tube.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
Bureau of Community Environmental Management
Division of Community Injury Control
Childhood Lead Poisoning Control Branch

APPENDIX 2E

DEPARTMENT OF PUBLIC HEALTH FORM LETTER

G. W. O. MOSS, M.D., D.P.H.
MEDICAL OFFICER OF HEALTH

J. W. MITCHELL, M.D., D.P.H.
DEPUTY MEDICAL OFFICER OF HEALTH

CITY OF TORONTO
DEPARTMENT OF PUBLIC HEALTH
CITY HALL
TORONTO CANADA
M5H 2N2

ADDRESS ALL CORRESPONDENCE TO THE MEDICAL OFFICER OF HEALTH
REPLY ATTENTION: Administration Services
Dr. J. W. Mitchell
TELEPHONE: 367-7403

The results of the analysis of your blood taken

per 100 millilitres of whole blood, by the Environmental Sciences Associates Inc. of Burlington, Mass., U.S.A., as follows:

In surveys by the Ontario Government the blood lead, in micrograms of lead per 100 millilitres of whole blood, of most people tested were in the following ranges:

Rural residents - From 5 to 15
City residents - From 5 to 30

We thank you very much for your co-operation in this survey.

Yours truly,

JWM/AS

Medical Officer of Health

APPENDIX 2F

PART ONE EPIDEMIOLOGICAL SURVEY FORMS

CONFIDENTIAL

Name Date of Birth Sex

Address Interviewer

Occupation or School (present or past lead exposure, in industry to auto fumes in garage or by extensive driving)

Length of residence at present address

Length of residence at previous addresses and duration (for past 5 yrs)

Approx. daily time spent at present address

Approx. daily time spent at any long absence in past 5 yrs.

Locally grown vegetables (kind, where grown, how often eaten)

Condition of paint in and around house

Lead worker in house (laundry, washing, bathing)

Birth Place and Date of Immigration

Cooking, food storage and preserving pots & vessels (lead in glaze or solder leached by acid foods)

Homemade wine and cider

Pot of stew or soup constantly simmering

Lead water pipes

House need frequent dusting

CONFIDENTIAL

Name: Date of Birth: Sex:

Address: Interviewer:

Occupation or School (present or past lead exposure, in industry to auto fumes in garage or by extensive driving)

Length of residence at present address

Length of residence at previous addresses and duration (for past 5 yrs.)

Approx. daily time spent at present address

Approx. daily time spent at any long absence in past 5 yrs.

Locally grown vegetables (Kind, where grown, how often eaten)

Condition of paint in and around house

Lead worker in house (laundry, washing, bathing)

Birth Place and Date of Immigration

Cooking, food storage and preserving pots & vessels (lead in glaze or solder leached by acid foods)

Homemade wine and cider

Pot of stew or soup constantly simmering

Lead water pipes

House need frequent dusting

Quality of housekeeping

Gas sniffing

CONFIDENTIAL

Name Date of Birth Sex

Address Interviewer

Occupation or School (present or past lead exposure, in industry to auto fumes in garage or by extensive driving)

Length of residence at present address

Length of residence at previous addresses and duration (for past 5 yrs)

Approx. daily time spent at present address

Approx. daily time spent at any long absence in past 5 yrs.

Locally grown vegetables (kind, where grown, how often eaten)

Condition of paint in and around house

Lead worker in house (laundry, washing, bathing)

Birth Place and Date of Immigration

Cooking, food storage and preserving pots & vessels (lead in glaze or solder leached by acid foods)

Homemade wine and cider

Pot of stew or soup constantly simmering

Lead water pipes

House need frequent dusting

Quality of housekeeping

Gas sniffing

Smoking

APPENDIX 2G

EPIDEMIOLOGICAL DATA—LEAD QUESTIONNAIRE PART ONE

CITY OF TORONTO — DEPARTMENT OF PUBLIC HEALTH

EPIDEMIOLOGICAL DATA – LEAD QUESTIONNAIRE PART 1

1. IDENTIFICATION NO.
2. SURNAME
3. GIVEN NAME
4. APT. NO.
5. STREET NO.
6. MOD
7. STREET CODE
8. STREET NAME
9. SEX — MALE / FEMALE
10. BIRTHDATE — D M Y
11. YR. OF IMMIG.
12. BIRTHPLACE
13. CODE
14. PRIMARY OCCUPATION TITLE
15. CODE
16. SCHOOL
17. GRADE
18. SECONDARY OCCUPATION TITLE
19. CODE
20. TELEPHONE No.
21. DATE OF HOME VISIT — D M Y
22. PREVIOUS OCCUPATIONAL LEAD EXPOSURE — Y (IF YES EXPLAIN ON REVERSE) / N / UNCERTAIN
NAME OF INTERVIEWER
23. LENGTH OF RESIDENCE AT PRESENT ADDRESS — YRS MTHS
24. LENGTH OF RESIDENCE IN THIS TEST AREA — YRS MTHS
25. LENGTH OF RESIDENCE IN OTHER TEST AREAS (LAST 5 YEARS) — YRS MTHS
26. ADDRESSES FOR PAST 5 YRS OTHER THAN ABOVE
27. DAILY HRS SPENT AT RESIDENCE — HRS
28. DAILY HOURS SPENT WORKING OR AT SCHOOL IN TEST AREA — HRS
29. TOTAL LONG ABSENCES LAST 5 YEARS — YRS MTHS
30. IS THERE A LEAD WORKER IN HOUSE — Y / N
31. IF YES
NAME OF COMPANY
32. OCCUPATION TITLE
33. CODE
34. IS HE/SHE TESTED AT WORK REGULARLY — Y / N
35. IF Y, BLOOD OR URINE — B / U
36. DOES HE/SHE USE PROTECTIVE CLOTHING AT WORK — Y / N
37. ARE WORK CLOTHES CHANGED AT WORK — Y / N
38. ARE WORK CLOTHES WASHED WITH FAMILY CLOTHING — Y / N
39. ARE SHOWERS USED AT WORK — Y / N
40. IS AN ELECTRIC KETTLE USED BY THIS PERSON — Y / N
IF YES
41. HOW MANY CUPS A DAY DOES THIS PERSON DRINK
42. HOW MANY CUPS A DAY ARE USED IN COOKING
43. IS THERE A HISTORY OF ANEMIA — Y / N
44. IS GASOLINE SNIFFING ADMITTED — Y / N
45. CHILD KNOWN TO INGEST PAINT — Y / N
46. CHILD KNOWN TO INGEST SOIL — Y / N
47. OBSERVED SIGNS OF PAINT PICA — Y / N
48. HOW LONG HAS PERSON BEEN SMOKING — YRS
USUAL TYPE OF SMOKING
49. CIGARETTE — 1
50. NO. OF PACKS A DAY
51. OTHER — 2
52. STATE TYPE AND QUANTITY
53. HAS PERSON STOPPED SMOKING IN PAST 5 YEARS — Y / N
54. IF Y, HOW LONG AGO — YRS MTHS
55. DO OTHERS IN THE HOUSE SMOKE — Y / N

37-175

APPENDIX 2H

DEPARTMENT OF HEALTH "WORRIED ABOUT LEAD" PAMPHLET

workers in heavy metal industries

worried about lead?

things you can do...

Have regular medical check-ups, including testing for lead levels.
Wash hands carefully before eating, drinking or after using the toilet facilities.
Do not eat or drink food in a lead work area.
Do not smoke in a lead work area.
Wear street clothes to and from work.
Change to working clothes at your place of employment.
Keep street clothes separate from working clothes.
Shower or wash carefully after work, before changing to street clothes.
Have work clothes cleaned at your place of employment or take them home in a bag and wash separately from regular clothing at home.
Use local exhaust hoses to clear air in a lead work area.
Wear approved respirators when working in a lead work area.

These measures will help to protect you and the other members of your family.

for more information...

If you want to know more about how to protect yourself and your family from the dangers of lead poisoning, talk to your doctor, public health nurse, or public health inspector.

The telephone number for inquiries in your district office is_____.

CITY OF TORONTO
department of public health

JULY, 1974

worried about **lead**

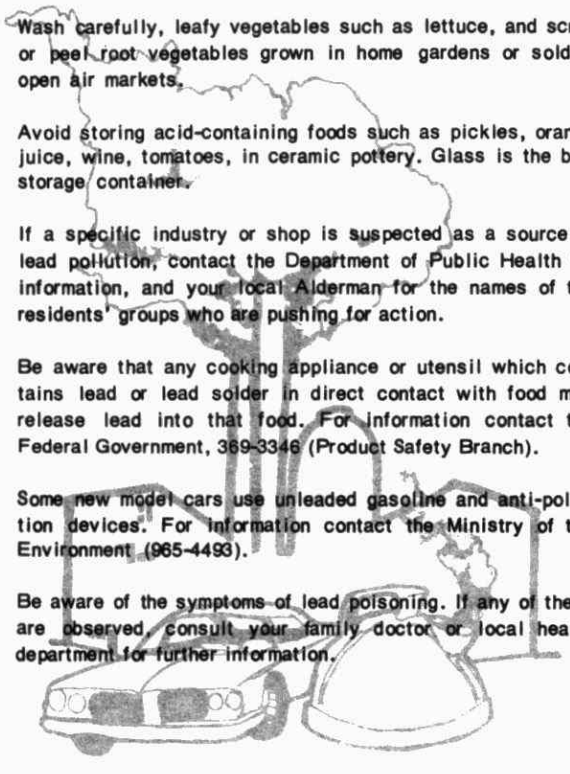
Lead is normally found in small quantities in the body. It is taken into the body most commonly by mouth or through the air that we breathe. Our body can dispose of this lead. When larger amounts of lead are taken into the body, there may be a danger to health.

Young children are more susceptible to the harmful effects of high levels of lead in the blood than are adults.

PROTECT YOUR FAMILY FROM THE DANGERS OF LEAD INTAKE!

Automobile emissions are a major source of lead in the air. Battery plants and smelters, as well as several other industries are identified as additional sources of lead.

things you can do	why
Discourage your child from putting potentially harmful substances such as paint chips, dirt, coloured newspaper, into his or her mouth. Encourage all family members to wash their hands frequently, especially before eating or handling food.	Lead is found in contaminated soil, in some paints, and in some dyes used to colour newsprint. Many articles may be coated with dust containing lead particles which can be picked up on the hands. This is a danger to young children.
Wash carefully, leafy vegetables such as lettuce, and scrub or peel root vegetables grown in home gardens or sold in open air markets.	Dust containing lead may settle anywhere, and must be removed. Vacuuming and wet dusting are more effective than sweeping and dry dusting.
Avoid storing acid-containing foods such as pickles, orange juice, wine, tomatoes, in ceramic pottery. Glass is the best storage container.	Glazes which might be used in some pieces of imported or home made pottery may contain lead. Acidic foods will leach out the lead from improperly glazed pottery.
If a specific industry or shop is suspected as a source of lead pollution, contact the Department of Public Health for information, and your local Alderman for the names of the residents' groups who are pushing for action.	Only when you care, will the problem be solved.
Be aware that any cooking appliance or utensil which contains lead or lead solder in direct contact with food may release lead into that food. For information contact the Federal Government, 369-3346 (Product Safety Branch).	Only when you care, will the problem be solved.
Some new model cars use unleaded gasoline and anti-pollution devices. For information contact the Ministry of the Environment (965-4493).	Only when you care, will the problem be solved.
Be aware of the symptoms of lead poisoning. If any of these are observed, consult your family doctor or local health department for further information.	If symptoms are recognized early and the source of lead intoxication removed, damage may be prevented.



EARLY SYMPTOMS OF LEAD POISONING

Lead affects different people in different ways. Some of the early symptoms are loss of appetite, abdominal pain, constipation, vomiting, anemia, irritability, lethargy.

APPENDIX 5A

METHOD OF CALCULATING PERCENTAGE OF POPULATION TESTED

The numbers of people tested by four age groups (0-4, 5-9, 10-14, 15+) and by distance (200 m. bands) from the centroids were obtained from the computer listing.

The corresponding number of people available for testing in each plant area was calculated as follows:

1. Using the 1971 census publications for Toronto the number of 'single residences' per census tract was calculated by subtracting 'apartments' from the total number of 'dwellings'.

2. The number of persons (by age) per 'single residence' was then calculated for each area.

3. Using large-scale maps, individual houses were counted within the 200 m. bands drawn around the plants.

4. The number of houses within each band was then multiplied by the figures for persons per single residence to give estimated populations.

5. The number actually tested was then divided by the estimated population to give the percentage tested.

The procedure in the Control Area was essentially the same, except that the figures were not divided into 200 m. bands.

APPENDIX 5B
MULTIPLE TESTING

During the City of Toronto blood sampling program, individuals could return for retesting if they wished; eight hundred and thirty people returned for second testings within two to 60 weeks after their first test.

It is a well-known fact that, in general, subsequent tests in an untreated population tend to regress towards the mean (i.e. low levels tend to increase, while high levels decrease). To demonstrate that this occurred in the population of the present study, a regression line was calculated relating the change in the blood lead level of an individual between first and second test to his or her first blood lead level.

This was done initially only on people whose first blood lead level was less than 30 mcg, because those with higher values were alerted to their condition and precautions or treatments were recommended for them. The accompanying graph shows the regression line for this group of 319 people, together with the mean of the differences between blood lead levels for people in the various intervals based on the first blood lead levels.

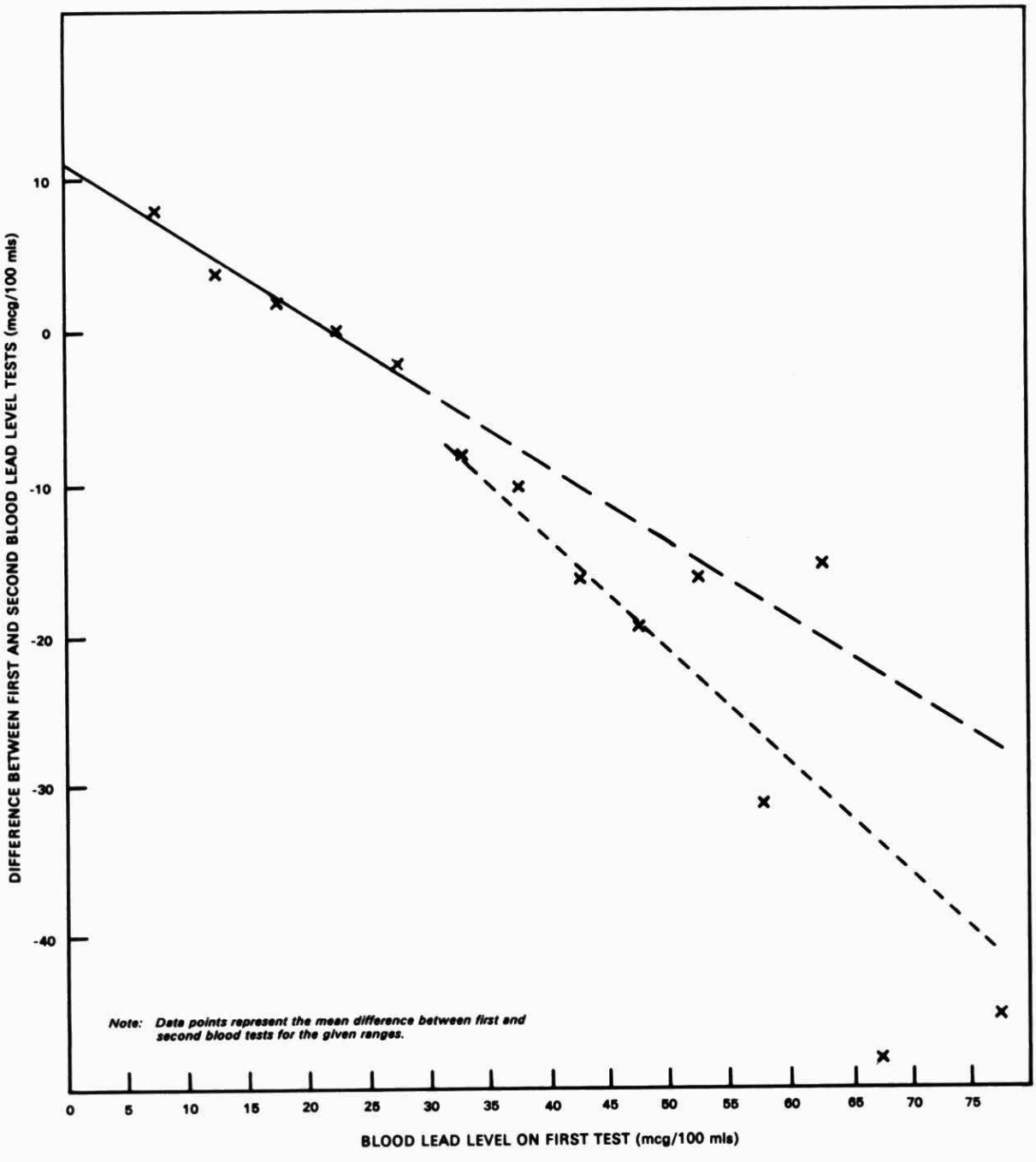
The accompanying table gives the regression parameters and the standard error of the slope.

As the graph shows, the relationship is very significant ($p<.001$), and it is also apparent that when the first test reading is near the overall average value (21 mcg), the second reading is practically identical to the first ("0" change). Values which were initially below the mean tended to increase (a positive difference between second and first blood lead reading) and those above the mean on the first test decreased (a negative difference). Moreover, the larger the difference between the initial value and the overall mean, the bigger the change in the direction of the correction of the initial value.

The extension of the regression line on the graph beyond the 30 mcg blood lead level is an indication of the change to be expected for those individuals whose first reading was 30 mcg or more, simply on the basis of regression toward the mean and without the effect of warning or treatment. The actual pattern by which the blood lead level changed for the 30 or more group is shown by the dotted line fitted to the data of this group of 511 individuals. The slope of this line is significantly steeper than that of the "expected" line, indicating that some of these people probably received treatment, or, by changing personal habits, reduced their lead intake in the interval between first and second tests.

REGRESSION EQUATION PARAMETERS

Blood Lead Level on First Test	Number of Cases	Constant	Slope	Standard Error of Slope
Under 30	319	11.2	−.501	.066
30 or over	511	16.0	−.730	.056



REGRESSION LINES OF THE DIFFERENCE BETWEEN THE BLOOD LEAD LEVELS ON FIRST AND SECOND TESTS VS. BLOOD LEAD LEVELS ON THE FIRST TEST.

APPENDIX 5C

LIST OF PEOPLE WITH ONLY MACRO BLOOD TESTS

Age	Sex	Distance[1](m.)	Blood Lead Level
33	M	79	22
31	F	79	29
11	M	79	49
10	F	79	25
9	M	79	33
8	M	79	55
41	F	98	26
16	F	98	10
15	F	98	13
13	M	98	9
48	M	85	19
10	F	87	16
64	F	95	20
62	M	95	22
66	M	95	29
60	M	85	37
61	F	91	9
29	M	91	19
24	F	91	22
2	F	91	27
47	F	101	12
20	F	101	7
14	M	101	3
8	F	101	3
50	M	107	17
8	M	79	43
7	F	79	39
5	M	79	29
74	F	98	11
72	M	98	5
29	M	81	16
30	M	81	14
65	F	91	18
72	M	91	15
43	M	85	19
54	M	85	24
27	F	85	—
12	M	101	16
51	M	101	17
19	M	101	16
68	F	105	15
39	F	105	15
42	M	108	27
35	F	108	20
11	F	108	19
35	M	108	22
24	F	108	12
42	M	110	15
50	F	104	19
11	F	104	10
11	M	104	17
19	F	104	13
36	M	79	37
30	F	79	14
34	F	104	8
14	M	104	21

[1]Distance measured from centroid of the plant

APPENDIX 5D

NUMBER OF PEOPLE BY AGE GROUP TESTED IN EACH DISTANCE RING

Toronto Refiners and Smelters

Distance Rings(m)	Age					
	0-4	5-9	10-14	15-44	45+	All
0-199	8	14	19	54	22	117
200-399	22	26	16	56	24	144
400-599	17	47	58	63	26	211
600-799	8	38	71	39	13	169
800-999	13	26	22	27	5	93
All	68	151	186	239	90	734

Canada Metal

Distance Rings(m)	Age					
	0-4	5-9	10-14	15-44	45+	All
0-199	15	30	27	53	48	173
200-399	68	121	108	194	109	600
400-599	56	157	130	89	44	476
600-799	37	114	128	80	28	387
800-999	6	49	50	31	15	150
All	182	471	443	447	244	1787

Prestolite

Distance Rings(m)	Age					
	0-4	5-9	10-14	15-44	45+	All
0-199	6	23	13	11	4	57
200-399	94	269	130	141	55	689
400-599	201	500	293	267	86	1347
600-799	140	356	257	220	41	1014
800-999	91	163	104	109	15	482
All	532	1311	797	748	201	3589

APPENDIX 6A
SEASONALITY

As was stated in Chapter 5.2, this report includes results of first blood tests sampled between May, 1973 and November, 1974. Since a substantial number of samples were taken in each of the four seasons, the possibility of seasonal variation should be investigated. The following table shows the distribution by season of the first blood tests in the four seasons by area.

To test if the data of this report indicate any difference in the blood lead level due to the seasonal changes, comparisons were made of first blood lead values taken in the winter (Oct.-Mar.) with those taken in the summer (Apr.-Sept.). Since confounding variables such as age and sex had to be accounted for, separate comparisons were made for child/adult, male/female

Seasonal Distribution of First Blood Tests

Area	Winter Jan.-Mar.	Spring Apr.-June	Summer July-Sept.	Autumn Oct.-Dec.
Toronto Refiners	0	245	480	9
Canada Metal	232	68	165	1,322
Prestolite	2,320	106	617	546
Control	960	14	5	3
Combined	3,512	433	1,267	1,880

groups. To eliminate the bias introduced by distance differences, the analysis of covariance method was used. This method compares the mean blood lead levels adjusted to a common average distance.

Only the Canada Metal and Prestolite areas were dealt with since in the Toronto Refiners area very few winter samples were taken, while in the Control Area most of the sampling was done in the winter.

As in the other tests in this report, a logarithmic transformation was used on the blood lead levels. Adjusted geometric means and significance levels are shown in the table below.

Although some of the comparisons show a statistically significant difference between the means of the summer and winter groups, neither seasonal mean is consistently higher than the other. Thus, out of eight cells the summer mean is higher than the winter mean in four (three statistically significant) and lower in four (two statistically significant). Hence, seasonal effects are unlikely to have seriously affected the analyses.

WINTER AND SUMMER GEOMETRIC MEAN BLOOD LEAD LEVELS ADJUSTED FOR DISTANCE DIFFERENCES

Area	Season	Male Children			Female Children			Male Adults			Female Adults		
		Number	Geometric Mean	S	Number	Geometric Mean	S	Number	Geometric Mean	S	Number	Geometric Mean	S
Canada Metal	Winter	220	25.6	NSD	244	21.5	**	181	25.6	*	262	20.4	**
	Summer	323	24.7		309	23.7		86	23.5		162	18.3	
Prestolite	Winter	1,076	20.0	**	1,077	18.1	**	254	22.2	NSD	495	15.3	NSD
	Summer	237	22.4		250	20.0		39	23.0		161	15.0	

S—Significance
*Significant at 5% level
**Significant at 1% level
NSD—No significant difference

APPENDIX 6B
SUMMARY OF RESULTS OF REGRESSION ANALYSES OF LN (BLOOD LEAD) VS. DISTANCE AND AGE

TORONTO REFINERS
(⩽1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	194	–.00025	.00009	**	–.00857	.00601	NSD	3.27739
Female – children <15 yrs.	211	–.00004	.00009	NSD	–.03720	.00566	***	3.28099
Male – adults ⩾15 yrs.	154	–.00003	.00013	NSD	.00077	.00171	NSD	3.08046
Female – adults ⩾15 yrs.	175	.00012	.00010	NSD	.00294	.00186	NSD	2.57339

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CANADA METAL
(⩽1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	543	–.00036	.00006	***	–.01626	.00390	***	3.53305
Female – children <15 yrs.	553	–.00036	.00006	***	–.02980	.00388	***	3.55176
Male – adults ⩾15 yrs.	267	–.00024	.00009	**	.00171	.00100	NSD	3.24032
Female – adults ⩾15 yrs.	424	.00030	.00007	***	.00364	.00092	***	2.96548

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

PRESTOLITE
(⩽1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	1313	–.00015	.00005	**	–.01687	.00280	***	3.22559
Female – children <15 yrs.	1327	–.00019	.00005	***	–.02401	.00289	***	3.20127
Male – adults ⩾15 yrs.	293	.00000	.00012	NSD	.00431	.00156	**	2.95015
Female – adults ⩾15 yrs.	656	–.00009	.00007	NSD	.00278	.00112	*	2.67542

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CONTROL AREA

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	441	–.00003	.00007	NSD	–.02013	.00484	***	3.13673
Female – children <15 yrs.	431	.00008	.00007	NSD	–.03150	.00468	***	3.12751
Male – adults ⩾15 yrs.	29	.00008	.00040	NSD	.00476	.00494	NSD	2.77813
Female – adults ⩾15 yrs.	81	–.00025	.00022	NSD	.00329	.00279	NSD	2.72763

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CANADA METAL AND CONTROL AREA

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	984	–.00025	.00002	***	–.01881	.00301	***	3.50118
Female – children <15 yrs.	984	–.00023	.00002	***	–.03069	.00297	***	3.49740
Male – adults ⩾15 yrs.	296	.00021	.00005	***	.00192	.00099	NSD	3.22241
Female – adults ⩾15 yrs.	505	–.00020	.00003	***	.00363	.00088	***	2.92499

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

TORONTO REFINERS
(<350 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	48	–.00469	.00080	***	–.02752	.01351	*	4.32579
Female – children <15 yrs.	47	–.00295	.00097	**	–.03944	.01463	**	3.88906
Male – adults ⩾15 yrs.	75	–.00148	.00073	*	.00054	.00242	NSD	3.39109
Female – adults ⩾15 yrs.	73	–.00232	.00089	*	.00655	.00320	*	2.93997

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CANADA METAL
(<350 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	156	–.00052	.00040	NSD	–.02632	.00731	**	3.68727
Female – children <15 yrs.	143	–.00008	.00042	NSD	–.04625	.00679	***	3.65736
Male – adults ⩾15 yrs.	142	–.00083	.00038	*	.00074	.00129	NSD	3.41759
Female – adults ⩾15 yrs.	190	.00007	.00036	NSD	.00199	.00133	NSD	2.93847

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

PRESTOLITE
(<350 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	214	–.00047	.00041	NSD	–.00324	.00749	NSD	3.23528
Female – children <15 yrs.	211	–.00059	.00036	NSD	–.00753	.00666	NSD	3.22874
Male – adults ⩾15 yrs.	53	–.00022	.00084	NSD	.00015	.00316	NSD	3.19095
Female – adults ⩾15 yrs.	123	.00050	.00053	NSD	.00296	.00232	NSD	2.49605

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CONTROL AREA
(<350 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	237	–.00001	.00022	NSD	–.02260	.00695	**	3.15797
Female – children <15 yrs.	273	.00001	.00021	NSD	–.03286	.00606	***	3.15385
Male – adults ⩾15 yrs.	18	–.00124	.00159	NSD	.00220	.00725	NSD	3.11222
Female – adults ⩾15 yrs.	42	.00100	.00075	NSD	.00346	.00395	NSD	2.45703

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

TORONTO REFINERS
(350-1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	146	–.00013	–.00014	NSD	–.01035	.00640	NSD	3.22354
Female – children <15 yrs.	164	.00017	.00012	NSD	–.03915	.00586	***	3.15558
Male – adults ⩾15 yrs.	79	.00018	.00024	NSD	.00042	.00241	NSD	2.96833
Female – adults ⩾15 yrs.	102	.00015	.00015	NSD	.00109	.00210	NSD	2.62926

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CANADA METAL
(350-1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	387	–.00013	.00009	NSD	–.00962	.00456	*	3.32292
Female – children <15 yrs.	410	–.00017	.00010	NSD	–.02342	.00463	***	3.37381
Male – adults ⩾15 yrs.	125	–.00011	.00016	NSD	.00310	.00158	NSD	3.11473
Female – adults ⩾15 yrs.	234	–.00034	.00012	**	.00538	.00127	***	2.92697

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

PRESTOLITE
(350-1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	1,099	–.00010	.00006	NSD	–.01909	.00301	***	3.21058
Female – children <15 yrs.	1,116	–.00010	.00006	NSD	–.02764	.00319	***	3.16754
Male – adults ⩾15 yrs.	240	.00005	.00015	NSD	.00554	.00180	**	2.87332
Female – adults ⩾15 yrs.	533	–.00012	.00009	NSD	.00273	.00128	*	2.69878

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

CONTROL AREA
(350-1,000 m.)

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	204	.00010	.00015	NSD	–.01812	.00676	**	3.04803
Female – children <15 yrs.	158	.00010	.00016	NSD	–.02926	.00739	***	3.09858
Male – adults ⩾15 yrs.	11	–.00136	.00046	**	.00447	.00392	NSD	3.64421
Female – adults ⩾15 yrs.	39	–.00036	.00051	NSD	.00286	.00407	NSD	2.78113

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

APPENDIX 6C

LIST OF UTM COORDINATES AND SOIL LEAD LEVELS FOR SAMPLES COLLECTED BY THE PHYTOTOXICOLOGY SECTION

Toronto Refiners

UTM COORDINATE X — Y	LEAD VALUE	UTM COORDINATE X — Y	LEAD VALUE
28890 — 33075	8400.000	28250 — 33305	157.000
28985 — 33040	3820.000	28760 — 33010	8200.000
29035 — 33170	687.000	28675 — 32955	8500.000
29165 — 33130	580.000	28575 — 32940	10800.000
29255 — 33155	563.000	28505 — 32890	2317.000
29355 — 33145	2170.000	28420 — 32885	1112.000
29435 — 33175	1477.000	28320 — 32935	1493.000
28850 — 33095	1763.000	28170 — 32940	758.000
28885 — 33180	1817.000	28770 — 32950	39000.000
29000 — 33250	1924.000	28750 — 32850	651.000
29015 — 33350	913.000	28720 — 32775	482.000
29035 — 33410	897.000	28640 — 32685	408.000
29105 — 33490	1357.000	28510 — 32580	364.000
29115 — 33585	148.000	28475 — 32495	436.000
28810 — 33090	1123.000	28830 — 32960	13600.000
28795 — 33165	1473.000	28850 — 32875	1002.000
28690 — 33265	321.000	28920 — 32765	2577.000
28760 — 33370	1223.000	28950 — 32670	1263.000
28725 — 33435	347.000	29005 — 32590	1667.000
28685 — 33555	723.000	28945 — 32495	1055.000
28660 — 33645	487.000	29000 — 32420	423.000
28765 — 33085	1923.000	28925 — 32960	15300.000
28665 — 33085	1053.000	29015 — 32910	3043.000
28605 — 33120	525.000	29115 — 32825	1302.000
28500 — 33135	345.000	29210 — 32760	1253.000
28420 — 33200	609.000	29315 — 32790	2480.000
28335 — 33230	940.000	29380 — 32760	2543.000

Prestolite

UTM COORDINATE X — Y	LEAD VALUE	UTM COORDINATE X — Y	LEAD VALUE
25745 — 36120	5800.000	25735 — 35995	2337.000
25690 — 36180	1000.000	25855 — 35965	1492.000
25655 — 36250	780.000	25805 — 35750	900.000
25635 — 36405	325.000	25970 — 35450	245.000
25470 — 36750	119.000	25800 — 36045	2527.000
25590 — 36170	548.000	25950 — 36000	485.000
25520 — 36175	365.000	25995 — 35890	399.000
25510 — 36255	390.000	26260 — 35740	407.000
25185 — 36325	233.000	25815 — 36110	1222.000
25610 — 36080	4343.000	25885 — 36250	746.000
25550 — 36060	1603.000	25990 — 36205	478.000
25435 — 36030	913.000	26090 — 36215	462.000
25370 — 35995	530.000	26385 — 36295	445.000
24910 — 35825	258.000	25745 — 36240	1710.000
25650 — 35975	478.000	25840 — 36235	1617.000
25465 — 35760	426.000	25840 — 36350	649.000
25400 — 35595	338.000	25980 — 36575	279.000
25690 — 36020	21500.000		

Canada Metals and Control Area

UTM COORDINATE X Y	LEAD VALUE	UTM COORDINATE X Y	LEAD VALUE
32600 — 35730	91.000	34150 — 34800	983.000
32645 — 35660	424.000	34195 — 35150	4083.000
32670 — 35575	1100.000	34215 — 35390	358.000
32725 — 35320	177.000	34220 — 35850	185.000
32755 — 35710	419.000	34255 — 35765	779.000
32760 — 35450	268.000	34280 — 34885	992.000
32765 — 35200	214.000	34280 — 35180	2870.000
32805 — 35095	471.000	34305 — 35275	884.000
32810 — 35105	374.000	34315 — 34765	2470.000
32830 — 35470	837.000	34325 — 34925	1537.000
32880 — 35360	704.000	34325 — 35665	355.000
32890 — 35110	150.000	34355 — 35535	257.000
32900 — 35265	621.000	34360 — 35210	2430.000
32915 — 34860	1370.000	34360 — 35480	798.000
32940 — 34995	1177.000	34365 — 35070	4800.000
32945 — 35125	78.000	34380 — 35420	1438.000
32955 — 35850	867.000	34385 — 35265	1993.000
32980 — 34740	311.000	34415 — 35300	2320.000
33035 — 35530	618.000	34445 — 35225	6500.000
33060 — 34910	1590.000	34505 — 34950	14000.000
33070 — 35840	496.000	34510 — 35050	18300.000
33075 — 34790	442.000	34515 — 35320	1296.000
33125 — 35190	629.000	34515 — 35430	567.000
33130 — 35690	313.000	34545 — 35270	6100.000
33190 — 34975	353.000	34550 — 35450	773.000
33205 — 35470	292.000	34575 — 34875	3037.000
33215 — 34850	1487.000	34590 — 34820	1630.000
33225 — 33940	818.000	34595 — 35120	3968.000
33250 — 35280	273.000	34600 — 35200	11300.000
33310 — 35745	293.000	34615 — 35525	1543.000
33325 — 35120	1070.000	34635 — 34670	1173.000
33350 — 35515	85.000	34640 — 35650	414.000
33470 — 35815	249.000	34645 — 35290	4703.000
33475 — 36015	237.000	34660 — 35775	410.000
33525 — 36050	88.000	34685 — 35065	950.000
33775 — 35000	869.000	34685 — 35370	2687.000
33805 — 35660	773.000	34720 — 35885	300.000
33850 — 35035	13800.000	34730 — 36010	130.000
33915 — 35575	790.000	34760 — 35040	673.000
33945 — 35050	1717.000	34760 — 35275	5900.000
33950 — 35450	268.000	34870 — 34990	340.000
34020 — 35070	2353.000	34885 — 35370	514.000
34060 — 34615	631.000	34960 — 35440	617.000
34080 — 35385	372.000	35015 — 34940	342.000
34115 — 35545	311.000	35040 — 35405	251.000
34120 — 35125	2797.000	35115 — 34895	107.000
34130 — 35925	171.000	35275 — 34795	65.000

APPENDIX 6D

LIST OF CITY OF TORONTO SOIL SAMPLE LEAD LEVELS AND CORRESPONDING ESTIMATED SOIL LEAD LEVELS

Toronto Refiners and Smelters

Area	UTM	Soil Est. From Phyto	City Samples	Area	UTM	Soil Est. From Phyto	City Samples
1	29190-33257	619	600	1	28664-33093	958	1000
1	28818-33093	1230	7000	1	28661-33100	928	900
1	28798-33087	1252	63	1	28794-33179	1440	600
1	28791-33085	1415	10000	1	28779-33175	1390	425
1	28678-33056	1822	4000				

Canada Metal

Area	UTM	Soil Est. From Phyto	City Samples	Area	UTM	Soil Est. From Phyto	City Samples
2	34760-35760	373	438	2	34594-35348	2939	1627
2	33930-35786	774	353	2	34579-35394	1200	225
2	34447-35244	5033	2500	2	34577-35401	1101	1008
2	34441-35263	3800	1100	2	34567-35432	849	1597
2	34420-35326	2079	1060	2	34565-35439	803	1390
2	34211-35538	323	332	2	34562-35447	823	817
2	34068-35719	427	414	2	34566-35435	834	1280
2	34281-35208	2548	2150	2	34656-35284	4640	2080
2	34266-35254	1447	607	2	34675-35290	4684	400
2	34262-35265	1323	977	2	34074-35172	2751	1895
2	34268-35246	1655	903	2	34023-35330	345	403
2	34256-35283	1031	925	2	33977-35485	383	425
2	34250-35300	687	486	2	34134-35442	339	600
2	34255-35286	909	968	2	34531-35257	6095	1200
2	34241-35329	529	475	2	34531-35256	6095	3000
2	34213-35410	356	529	2	34531-35256	6095	2500
2	34211-35416	356	515	2	34527-35268	5059	2000
2	34293-35509	468	650	2	34527-35268	5059	1810
2	34506-35585	842	725	2	34525-35274	4868	2030
2	34548-35268	5893	2560	2	34484-35402	611	500
2	34625-35359	2814	1545	2	34204-35166	3966	1090
2	34907-35486	611	1000	2	34202-35173	3871	100
2	34353-35652	325	700	2	34192-35202	3404	950
2	34351-35658	325	500	2	34185-35223	3159	1350
2	34349-35663	343	288	2	34183-35230	2966	1800
2	34279-35869	276	363	2	34169-35273	1678	920
2	34365-35209	2403	900	2	34167-35279	1399	500
2	34361-35221	2371	213	2	34160-35301	700	1010
2	34288-35444	678	682	2	34148-35336	389	1050
2	34567-35710	396	378				
2	34502-35902	394	217				
2	33689-35059	65	638				

Prestolite

Area	UTM	Soil Est. From Phyto	City Samples	Area	UTM	Soil Est. From Phyto	City Samples
3	26440-35775	407	1250	3	25981-35744	598	940
3	26331-36119	445	637	3	25256-35701	344	890
3	26069-35261	245	436	3	25727-35738	883	328
3	25912-35724	874	368	3	25557-35685	419	288
3	25902-35753	857	3492	3	25538-35680	412	401
3	25879-36030	1339	1213	3	25533-35678	411	538
3	25419-35854	473	554	3	25782-35646	846	400
3	25356-35848	452	739	3	25365-35697	377	372
3	26009-35775	383	380	3	25252-36061	483	1178
3	25950-35956	609	543	3	26145-36046	441	198
3	25926-36029	714	1488	3	26332-35798	407	460
3	26309-35850	407	435	3	26301-35893	407	155
3	26051-35766	370	521				

APPENDIX 6E

SUMMARY OF RESULTS OF REGRESSION ANALYSIS OF LN (BLOOD LEAD) VS. SOIL LEAD LEVEL AND AGE

REGRESSION OF LN (BLOOD LEAD LEVEL) VS. SOIL LEAD LEVEL AND AGE
(For Distances ⩽500 m. from Plant Centroid)

TORONTO REFINERS

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	73	.00037	.00011	***	–.00601	.01117	NSD	2.85231
Female – children <15 yrs.	82	.00010	.00006	NSD	–.03560	.01049	***	3.14745
Male – adults ⩾15 yrs.	110	.00003	.00006	NSD	.00229	.00212	NSD	2.97452
Female – adults ⩾15 yrs.	103	.00011	.00007	NSD	.00445	.00249	NSD	2.45151

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

REGRESSION OF LN (BLOOD LEAD LEVEL) VS. SOIL LEAD LEVEL AND AGE
(For Distances ⩽500 m. from Plant Centroid)

CANADA METAL

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	296	.00006	.00001	***	–.01805	.00532	***	3.32423
Female – children <15 yrs.	269	.00008	.00001	***	–.03912	.00491	***	3.40094
Male – adults ⩾15 yrs.	193	.00006	.00001	***	.00137	.00111	NSD	3.06550
Female – adults ⩾15 yrs.	286	.00002	.00001	NSD	.00278	.00106	*	2.88939

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

REGRESSION OF LN (BLOOD LEAD LEVEL) VS. SOIL LEAD LEVEL AND AGE
(For Distances ⩽500 m. from Plant Centroid)

PRESTOLITE

Group	Number of Cases	Distance from Centroid			Age			Constant
		Slope	Standard Error	Significance	Slope	Standard Error	Significance	
Male – children <15 yrs.	432	.00015	.00005	**	–.01093	.00522	*	3.06795
Female – children <15 yrs.	439	.00003	.00002	NSD	–.01841	.00525	***	3.08909
Male – adults ⩾15 yrs.	114	.00007	.00014	NSD	.00292	.00239	NSD	2.98751
Female – adults ⩾15 yrs.	216	.00003	.00003	NSD	.00348	.00169	*	2.60497

*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

APPENDIX 7A

GUIDELINES FOR COMPLETING PART ONE EPIDEMIOLOGICAL QUESTIONNAIRE SURVEY FORMS

EPIDEMIOLOGICAL DATA LEAD QUESTIONNAIRE—PART 1

I. OBJECTIVES FOR THE PUBLIC HEALTH NURSE:

A. To gather precise, objective data about specific primary or secondary lead sources of human lead intoxication. This data and that gathered by the health inspectors will be analyzed by computer to elicit any significant correlations among the answers and blood lead levels.
B. To begin preventive health teaching in regard to sources of lead intoxication, both in the home and/or at work.
C. To serve as a casefinder for problems or needs that the family may overtly or covertly define, not related to the lead issue.

II. GENERAL LEAD QUESTIONNAIRE GUIDELINES:

A. For general information about the topic of lead intoxication, please review the following:
   1. The folder entitled "Lead Investigation" located in the General File in the district office.
   2. The pamphlet entitled "Worried about Lead" also available in the district office.
B. A questionnaire should be completed for *each member* of the family who was tested.
C. Most of the questions are specific for *the individual* named in the questionnaire.
D. During the preparation for the home visit, it is advisable that the public health nurse check the active and discharge files in the district office to see whether the family is already known to the agency.
E. During the home visit, the nurse may have to interpret many questions to the family in order to clarify accurate answers and to prevent feelings of privacy invasion or misunderstandings.
F. If the answer to any question is not known, indicate this by inserting "N.K." in the boxes provided for that question. If the question is not appropriate for this individual, insert the letters "N.A.". All spaces should be *filled.*
G. A public health inspector will visit the home of every family where there is an individual with a blood lead level over 40 mcg/100 ml. blood. It would be most helpful if the public health nurse would explain this to the family and leave with them a copy of the mimeographed note to this effect as well as a copy of the pamphlet "Worried about Lead". These are available in the district office.
H. Please print all information.

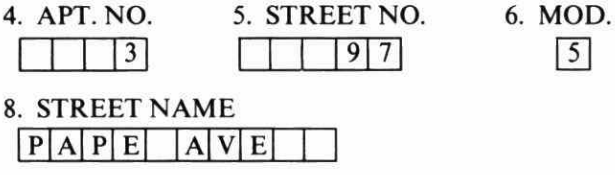
III. GUIDE FOR COMPLETING EPIDEMIOLOGICAL LEAD DATA QUESTIONNAIRE

GENERAL DATA SECTION

1. IDENTIFICATION NUMBER: *This number will be assigned by the computer.*

2,3. SURNAME, GIVEN NAME: Print (one letter of the name in each block).

4,5. APT. NO., STREET NO.,: If the home has no apartment number, insert "N.A.". If there are less than four digits in either of these numbers, please complete as follows: e.g. APT. 3, 97½ PAPE AVE.



6. MODIFIER: If address is 97½ Pape Avenue, insert "5" here; or if address is 97A Pape Avenue, insert "A" here. Note: This must be a *separate residence* and not an apartment within the same address. Insert "N.A." if not appropriate.

7. STREET CODE: *This number will be assigned by the computer.*
8. STREET NAME: Print.
9. SEX: Check Male or Female.
10. BIRTHDATE: Fill in the day, month and the last two digits of the year.
11. YEAR OF IMMIGRATION: Fill in the last two digits of the year of immigration. Insert "N. A." if born in Canada.
12. BIRTHPLACE: If the person was not born in Toronto, please state the province in Canada or the country of birth.
13. BIRTHPLACE CODE: Please refer to appendix for this code and insert appropriate number(s) in the space(s) provided.
14. PRIMARY OCCUPATION TITLE: Fill in the person's primary, *full time* job title, if employed. If not employed, fill in the most appropriate activity description: student, homemaker, retired, disabled, unemployed, preschool or infant.
15. PRIMARY SCHOOL/OCCUPATION CODE: The school part of this code will be assigned according to the coded lists in the district office. The occupation part of this code is included in the appendix.

16,17. SCHOOL, GRADE: Fill in the name of the school this person attends presently and the present grade. If the class is ungraded, fill in the word "ungraded".

18. SECONDARY OCCUPATION TITLE: *If* the person has a secondary occupation, in addition to the one listed above, write in that secondary job title here. Examples include a person holding two different full-time jobs or combinations of part time, seasonal jobs.
19. SECONDARY/OCCUPATION CODE: Same as above.
20. TELEPHONE NO.: Insert "N.A." if there is no telephone.
21. DATE OF HOME VISIT: Fill in the date of the interview.
    INTERVIEWER: Fill in your name.
22. PREVIOUS OCCUPATIONAL LEAD EXPOSURE: Check yes, if this individual has been a lead worker during the past *five* years. For a review of lead occupations see lead worker code included in the appendix. On the reverse side of the questionnaire, please describe the job title and place of employment. Also include here possible hobbies or recreational interests where this individual may be exposed to lead.

RESIDENCE SECTION

23. LENGTH OF RESIDENCE AT PRESENT ADDRESS: Fill in the number of years and months that this individual has lived at the present address.
24. LENGTH OF RESIDENCE IN THIS TEST AREA: Fill in the number of years and months that this person has lived *in this area.* This question is included because the individual may have moved from one house in the area to another house within the same area. Consult the lead district map specific to your test area. This is included in the appendix.
25. LENGTH OF RESIDENCE IN OTHER TEST AREAS IN THE PAST FIVE YEARS: If this person has lived in another lead district within the last five years, fill in the number of years and months. Consult the lead district map to determine if the person has lived in other test areas.
26. ADDRESSES OF PAST FIVE YEARS OTHER THAN ABOVE: Please list and be as precise as possible, and begin with the most recent address. If the address is within the City of Toronto, state the street number and name. If the address is elsewhere, state the name of the city or town.
27. DAILY HOURS SPENT AT RESIDENCE: Fill in the average number of hours per work day spent at this residence.
28. DAILY HOURS SPENT AT WORK *OR AT SCHOOL* IN THIS OR ANOTHER TEST AREA: If this individual goes to school or works in any lead district (see map with lead district boundaries), fill in the daily average hours spent at work or school. If this person neither works nor attends school in a lead district, insert "N.A.".
29. TOTAL LONG ABSENCES IN PAST FIVE YEARS: Fill in the total length of time of all *one month or*

more absences from this lead district in the past five years. Example: summer vacations of one month or longer. If there have been no absences, or absences of less than one month, insert "N.A.".

LEAD WORKER SECTION

In addition to data gathering, this section provides an important tool for occupational health teaching. Any untested lead worker in the family should be encouraged by the nurse to have a blood test done.

30. IS THERE A LEAD WORKER IN THE HOUSE: Check yes, if *any household member* works in any job described in the lead worker code. On the reverse of the form, state this person's name and relationship to the individual named in the questionnaire. If not, fill in "N.A." for the following questions and go on to question 40. If uncertain about a possible lead worker in the house, ask all the lead worker questions and clarify this with your supervisor.
31. NAME OF COMPANY: Print the name and address of the lead worker's employing company.
32. OCCUPATION TITLE: Print the lead worker's job title.
33. LEAD WORKER CODE: This code is included in the appendix. Categorize and code the lead worker's job in the box provided.

34,35. IS HE/SHE TESTED AT WORK REGULARLY; BLOOD OR URINE: Check yes, if the lead worker has a lead test at least once a year. Check no, if none is done. If yes, check whether a blood or urine test is done.

36. DOES HE/SHE USE PROTECTIVE CLOTHING AT WORK: Check yes, if coveralls uniform etc., is used by the lead worker. Check no, if not used. Fill in "N.K." if not known.
37. ARE WORK CLOTHES CHANGED AT WORK: Lead containing dust can be brought into the home if a lead worker wears work clothes home. Check yes, if worker changes to street clothes before leaving work. Check no, if not changed.
38. ARE WORK CLOTHES WASHED WITH FAMILY CLOTHING: If clothes are washed together, lead containing dust may be dispersed to the clothing of other family members. Check yes, if clothes are washed together. Check no, if work clothes are laundered at work or are washed *separately* from regular family wash.
39. ARE SHOWERS USED AT WORK: Check yes, if the lead worker regularly showers at work before he leaves to go home. Check no, if this is not done. If a shower is available, the worker should be encouraged to use it regularly. If one is not available, the worker should be encouraged to shower upon arriving home.

ELECTRIC KETTLE SECTION

Recent evidence suggests that water boiled in some electric kettles becomes contaminated by lead leached from solder material used in the kettle's manufacturing process. This lead source could be particularly hazardous to infants or small children if used in formula preparation, cereal or juice dilution.

40. IS AN ELECTRIC KETTLE USED BY THIS PERSON: Check yes, if:
    1) this individual is an *adult* and drinks more than an average of 1 cup a day
    2) this individual is a *child* and drinks any amount more than 1 cup per week.

    IF YES,

41. HOW MANY CUPS A DAY DOES THIS PERSON DRINK:
42. HOW MANY CUPS A DAY ARE USED IN COOKING:

    For both of these questions fill in the approximate number.

ANEMIA SECTION

There is some evidence that different persons, such as those with a history of anemia or other hemoglobinopathies, respond differently to a given dose of lead. The individual with a pre-existing anemic condition may be more susceptible to lead intoxication. This person's blood lead level may not accurately reflect his body's total lead burden be-

cause 90% of lead is attached to the red blood cells. In such an individual, symptoms, can occur at blood lead levels slightly above "normal". Anemia is also one of the clinical indicators of an elevated blood lead level. Lead has been shown to interfere with hemoglobin synthesis and fragility.

43. IS THERE A HISTORY OF ANEMIA: Check yes, if the person has any history of anemia including sickle cell anemia or thalassemia.

GASOLINE SECTION

44. IS GASOLINE SNIFFING ADMITTED: Most gasoline contains lead. This question pertains to the individual who deliberately sniffs gasoline as a means of attaining a "high" or altering the state of consciousness. Check the appropriate answer here.

PICA SECTION

Pica refers to the habit of eating nonfood substances including peeling paint, plaster, putty and dirt.

Paints prior to 1940 contained 50% or more lead but since then, the use of lead in indoor paint has greatly decreased. The Federal Government has recently set 0.5% lead as a maximum of indoor paint. However, the old high lead paint remains on the walls and trim and painting over it with low lead paint does not decrease the hazard. The only certain ways to remove the hazard is to remove the paint on the trim down to the bare wood or to cover paint on the walls with plywood or hardboard paneling to a height of four feet from the floor so as to bar children's access to the paint. A few thumbnail-size paint fragments can contain 250,000 mcg of lead.

City soil usually contains 300-600 parts per million (ppm) lead. Soil levels of 5,000 to 10,000 ppm have been measured very close to some lead plants. Although this is less concentrated than paint, soil is generally available in greater quantity. The Board of Health is considering a guideline maximum of 1,000 ppm for lead in soil.

45. CHILD KNOWN TO INGEST PAINT: Directly question an adult about this and check appropriate answer.

46. CHILD KNOWN TO INGEST SOIL: Same as above.

47. OBSERVED SIGNS OF PAINT PICA: Does the nurse *see* any teeth marks on porch, window ledges, toys or see the child picking up paint chips.

SMOKING SECTION

Smoking contributes to further sources of lead ingestion or inhalation. The individual who smokes seems to absorb a larger percentage of inhaled lead particles that may be present in the air. Also, people exposed to lead dust particles at work or to lead contaminated soil while gardening, may ingest lead particles if handwashing is not done before putting the cigarette to mouth.

48. HOW LONG HAS PERSON BEEN SMOKING: Fill in the approximate number of years, or "N.A." if not appropriate.

USUAL TYPE OF SMOKING:

49. CIGARETTE: Indicate with check mark or insert "N.A." if not appropriate.

50. NO. OF PACKS A DAY: Insert the average number here. To indicate a half pack, insert 5 after the decimal point.

51. OTHER: Indicate with check mark if this person smokes a pipe or cigars. Insert "N.A." if not appropriate.

52. STATE TYPE AND QUANTITY: Fill in the kind of smoking and the approximate daily frequency of use.
    Note: If one smokes both cigarettes and cigar or pipe, please complete questions 49, 50, 51, 52.

53. HAS PERSON STOPPED SMOKING IN PAST 5 YEARS: Insert "N.A." if not appropriate.

54. IF YES, HOW LONG AGO: Fill in the approximate number of years and months.

55. DO OTHERS IN THE HOUSE SMOKE: If the question is not appropriate, insert "N.A.".

NOTE: If the nurse is aware of any significant medical information about the individuals on whom she is completing a questionnaire, such as a chronic illness, a heriditary disease, etc., please note this on the reverse of the form.

IV. APPENDIX

1. BIRTHPLACE CODE
2. OCCUPATION CODE
   DEFINITIONS FOR THE WORKER CODE
3. LEAD WORKER CODE
4. MAP OF LEAD DISTRICTS

Birthplace Code

NAME OF PLACE	CODE
Not Stated	X
Toronto	00
Ontario	01
Quebec	10
Nova Scotia	11
New Brunswick	12
Prince Edward Island	13
Manitoba	14
Saskatchewan	15
Alberta	16
British Columbia	17
Newfoundland	18
Canada	19
England and Wales	20
Ireland	21
Scotland	22
West Indies	23
Jamaica, Bermuda, Antigua, St. Martin, St. Christopher, St. Lucia, St. Vincent, Barbados, Trinidad, Grenada, Dominica, Virgin Islands, Puerto Rico, Haiti, Cuba, Santa Domingo, Martinique, Guadeloupe.	
India, Burma, Pakistan, Bangladesh, Sri Lanka (Ceylon)	24
East Indies, Borneo	25
Australia, New Zealand	29
U.S.A.	30
Mexico	35
Guatemala, Honduras, Nicaragua, Panama, Costa Rica, Salvador	36
South America	40
Africa	45

NAME OF PLACE	CODE
At Sea	48
Other Countries	49
Russia, Ukraine	50
Estonia, Latvia, Lithuania	51
Poland, Galicia	52
Finland	53
Denmark, Iceland, Holland, Norway, Sweden, Netherland	54
Germany	55
Czechoslovakia, Croeta	56
Austria	57
Hungary, Roumania, Bukovinia	60
Bulgaria	61
Albania	62
Greece, Cyprus, Malta	63
Yugoslavia, Servia, Macedonia	64
Italy, Sicily, Corsica, Sardinia	65
Switzerland	70
Belgium	71
France	72
Spain, Portugal	73
Other Europe	74
Israel, Lebanon	79
Turkey	80
Armenia	81
Persia, Syria, Arabia, Iran, Iraq	82
China, Hong-Kong	85
Japan	86
Other Asia, Korea, Indonesia, Thailand, Tibot, Sumatra, Vietnam, Malay, Philippines	89

OCCUPATION/SCHOOL CODE

Code	Students
1-450	—Each City of Toronto public school has its own code number. Please refer to the list in the district office for this.
466	—All private schools within the City of Toronto
477	—All schools outside the City of Toronto
488	—All colleges, universities, training and retraining programs.

Code	People Who Are At Home
500	—Infants (under 1 year)
511	—Pre-school
522	—Homemaker
533	—Retired
544	—Disabled
555	—Unemployed

Code	Workers
600	—Lead worker
611	—Clean, inside worker
622	—Clean, outside worker
633	—Dirty, inside worker
644	—Dirty, outside worker
655	—Unknown

DEFINITIONS FOR THE WORKER CODE

LEAD WORKER: Any job described in the lead worker code.

"CLEAN": Hands and clothing are not regularly soiled in this type of occupation. Examples: office worker, sales clerk, nurse.

"DIRTY": Hands and clothing are regularly soiled in this type of occupation. Example: fireman.

"INSIDE": This occupation is primarily performed inside a building. Examples, Factory worker, teacher.
"OUTSIDE": This ocupation is primarily performed outside a building. Example: Construction worker.

LEAD WORKER CODE

Code	Worker
6	—The overt lead industry worker. This worker has direct contact with large quantities of molten lead, lead fumes or lead-containing dust. Places of employment include lead smelter and battery plants and factories that use lead oxide in the manufacturing process.
5	—The person who works with all other varieties of melted lead or lead or lead dust, but in much smaller quantities. This includes the solderer and linotype worker and the plumber and roofer who use lead for making joints, repairs, etc. Also included are scrap metal workers.
4	—All varieties of painters (except those who work in garages or car body shops). This includes house and institution painters and workers who paint in industry (for example, painting tennis rackets and furniture, etc.)
3	—Any person who works in an automobile garage or body shop. This worker has contact with lead gasoline fumes and possibly lead dust (in addition to many non-lead but still dangerous solvents). People who repair mufflers and/or do car body sanding are at particular risk from lead dust.
2	—All full-time drivers and curb workers who primarily work in urban neighborhoods have exposure to lead gasoline fumes. This includes taxi, bus and city truck drivers, parking lot attendants, police officers who work on the beat or patrol, sanitation workers, mail carriers, etc.
1	—All "other" types of lead workers. This description is a catch-all for those job descriptions, which do not obviously fit in the above six categories. If this category is used, please describe the job on the reverse side of the questionnaire.

APPENDIX 7B

EXAMPLE OF INITIAL PART TWO EPIDEMIOLOGICAL SURVEY FORM

CITY OF TORONTO
DEPARTMENT OF PUBLIC HEALTH

COMPLAINT FORM

Date ..... 19.....

Street and No. .....

Owner or Agent and Address ..... Phone .....

Occupant ..... Phone .....

Type of Business .....

Complainant .....

Address of Complainant ..... Phone .....

Date Investigated .....

Nature of Complaint .....

.....

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Report of Inspector

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Action Advised ..... Inspector .....

30-612-412

(over)

Street and No. ..... District ..... Entered ..... Re-inspection

Continuation of Report

APPENDIX 7C

GUIDELINES FOR COMPLETING PART TWO EPIDEMIOLOGICAL QUESTIONNAIRE SURVEY FORMS

GUIDE FOR COMPLETING THE ENVIRONMENTAL LEAD SURVEY QUESTIONNAIRE

Each home in which sampling is conducted this lead form will be used. This will allow head office to feed into the computer all the data you have collected. The success of this system however is largely dependant on the consistency with which you interpret the question part of this form and the detailed sampling identification system adopted to meet computer requirements.

CONSISTENCY is the key to making this form work.

QUESTIONNAIRE: (Front page)

1. Apt. No.—enter here the apt. number. In the case of a home where there is no apt. number leave this space blank.

2. Street No. numbers are entered starting with the right side spaces.

Hence a single digit No. is 8
if a two digit No. 18
if a three digit No. 218

		8
	1	8
2	1	8

if No. is 18A or 18B or 18½ enter the whole number *only* as 18 the A, B, or ½ is entered in space No. 3 Mod.

3. MOD Note: This section applies only if two separate residences.
Example 18 Doe Street and 18½ Doe Street. This does not apply to apartments in the same building.

If address 18A enter the A
18B enter the B
18½ enter the ½

A
B
½

4. Street Code—This number will be assigned by the computer.

5. Print FULL and CORRECT name of street. i.e. Marigold St. not just Marigold. Rushbrooke Ave. Not Rushbrook Ave.

6. Telephone No. self explanatory.

7. *Date of inspection*—Please adopt the continental system of date designation, i.e. always in ASCENDING magnitude. DAY/MONTH/YEAR.

8. *Inspector*—Print initials and last names of inspectors conducting survey.

9. *Is there a lead worker in the house*—We are looking for someone who is actively engaged in a lead plant or related lead exposure trade or profession. i.e. scrap and salvage yards, Body shop workers, trades which conduct considerable soldering operations. i.e. workers who solder electric appliances. i.e. kettles.
If YES then complete questions "10 and 11" (Omit # 12)

10. As above.

11. As above.

12. As above.

13. *Type of building*—Check √ which applicable. Semi, Det, Row, are self explanatory. Apt, refers to a self contained apartment only. Comm refers to store factory garage etc. Example the second floor above a variety store would be designated as "Apt". If samples were taken from the variety store it would be "Comm".

14. *Construction*—Check off as applicable if "Other" check off necessary then make appropriate remarks in the #42 Remarks area. PRECEED YOUR REMARKS WITH THE QUESTION NUMBER TO WHICH IT APPLIES. i.e. If a Adobe hut then in the remarks column you list # 14—adobe.

15. *Condition of building*—GOOD—Walls, floors, ceilings, intact paint work, inside and out good. Structurally sound, no visible building defects.

FAIR—Building in need of minor maintenance work including painting, structurally still sound. EXAMPLE: there would be no need to refer the minor defects to other agencies.
POOR—Minor and major maintenance and structural repairs needed. i.e. extensive paint and plaster peeling or crumbling, both inside and out.

16. *Paint peeling or chipping seen*—Indicate by checking off the Y square for yes and N square for no. The intent here is to point out moderate or extensive evidence of paint peeling or chipping which in the case of inside could be ingested by children, and in the case of outside could attribute to a elevated lead level in the soil. This question has a direct relationship with questions 23 to 28.

17. Same as per question # 16.

18. *Water service plumbing*—Look scrape or tap piping to determine composition of water service plumbing. Please search carefully since in many homes two or all three types of metals listed can be found. √ check off applicable squares.

19. *Type of central heating*—Include ALL HOT AIR FURNACES IN THE "FORCED AIR" square.
Other—includes hot water, steam etc. if you find something extraordinary make appropriate comments in the "remarks" column. (Air ducts vs Radiators dust dispersion)
√ check off applicable square.

20. *Is there a backyard*—√ check off Y if yes
√ check off N if no

21. Is it used by child as a play area—the question we are asking here do the children primarily play in the confines of the yard area. This can to a great extent be determined by whether or not there are any play things in the yard i.e. swings, sand box etc. Check off Y or N.

22. *Type of surface*—Check off applicable, one two or all three squares as needed.

23. Housekeeping—*Good*—clean orderly, no visible dust, dirt, litter, clean furnishings.
Fair—home can be disorderly and disorganized yet still remain reasonably clean. No LONG term accumulation of dust and dirt on furnishings, corners of floor etc.
Poor—Long and short term dust and dirt accumulation in corners under furniture etc. littered generally neglected.
√ check off appropriate square.

24. *Does house need frequent dusting*—This question is asked of the occupant. Is the house located on a busy street or is there a industrial process near by which contributes more than the normal amount of household dust. Check off Y—yes or N—no.

25. *Is dust visible on rugs, floors and furniture*—Check off appropriate square.

26. Hygiene—We are dealing in generalities here and are primarily concerned with the children population of the home.
GOOD—Personal appearance and clothing clean hands washed particularly prior to eating.
FAIR—Short term dirt and soil on hands, face and clothing. Any child coming in from playing outside will have dirty hands, face and clothing.
POOR—Long term dirt and soil encrusted hands, faces, clothing. Children observed eating without washing their visibly dirty hands etc.

NOTE Every inspector has had sufficient exposure in the normal day to day sanitation investigations to be able to accurately assess the degree of hygiene in a home. THIS QUESTION IS BASED ON OBSERVATION ONLY, DO NOT ASK THE OCCUPANTS. If the occupants are looking over your shoulder during the inspection please make the appropriate entry after you have left the home.

27. *Is vacuum or wet mop used mostly*—The intent here is to determine whether occupants use one or both of these methods of dusting which are considered the proper method of dust removal and pickup or do they simply dry dust which in the final result simply disperses the dust in the air. This becomes extremely important in cases where laboratory analysis show high Pb content in the home dust. Check off appropriate Y if yes, N if no.

28. Evidence of Pica—This refers to children habitually ingesting paint, paint nibbled or chewed from furnishings i.e. cribs, beds, high chairs etc. chew marks on window sills, door frames and any other accessible areas to children. If Y for yes please make notation in 42 Remarks column.

29. *Are home grown vegetables eaten*—self explanatory, check if yes or no. This question is extremely relative particularly when results show the Pb levels on vegetables were extremely high in lead areas. Washing of these vegetables significantly reduced the Pb. Raddishes were the only exception, Pb levels remained extremely high.

30. *Small or large amounts*—Check off small if resident grows only a few vegetables i.e. two to six tomato plants, one row of lettuce, beans and a few carrots. This as compared to gardens maintained by many ethnic groups which in many cases take up one to two thirds of the yard area. Perhaps the question of whether does the garden represent

a hobby usually on a very small scale or does the quantity grown in your opinion represent the fresh vegetable intake for this particular family for the entire summer.

31. Check off any of the listed vegetables grown. If vegetables grown not on list check off "other" and specify in the "specify" column.

32. *Washed and Not washed*—Proper washing consists of scrubbing root vegetables, soaking and rinsing leaf vegetables etc. This question obviously must be asked of the women of the home.

33. *Are fruit juices, acid stews, tomatoes etc. stored in ceramic, pewter, lead pots or containers with solder*—Acidic foods or liquids cause lead if present in the storage vessel to leach out. This becomes an important factor in these acidic substances are stored for a period of time. Look and ask. Check off if yes or no.

34. *Is homemade wine or cider made or stored in ceramic or porcelain at any time.* As in question 33 acidic foods or liquids. The large earthen crocks used in primary fermentation of wines or curing of sauerkraut are suspect. If YES attempt to get a sample of the liquid stored in a crock.

35. *Is there a pot of stew or soup constantly simmering on the stove*—This question is self explanatory check off Yes or No.

36. *Does House use canned milk*—The intent here is Baby milk i.e. Enfalac, Nutrilac, Similac etc. etc. Milk intended for infant feeding. It was found that beads of solder with which these cans were closed released Pb into the product. (U S case no evidence of this occuring in Canada) Check off yes or no, if yes answer question #37.

37. *If yes brand name and code.* Indicate brand name on top line, code no. on bottom.

38. *Is an electric kettle used in the Home*—indicate—check off yes or no.

39. Kettle water sample taken—indicate if kettle water sample was taken.
SAMPLING PROCEDURE** 1. empty and rinse kettle
2. fill kettle with one litre of cold water
3. boil for 15 minutes
4. pour remaining water in laboratory water bottle
5. identify and record

40. *Brand name*—indicate kettle brand name, abbreviate if needed.

41. *Model No.*—indicate model no.

42. *Remarks*—proceed any remarks with the question no. to which it applies.

CODING

The first four columns identify:

1. Floor
2. Room type
3. Location of this room within the house
4. Occupancy i.e. which of the occupants one or more occupy this room hence these four columns tell you exactly who sleeps in the room located in a certain area of the house; identifies the type of room and tells you on which floor the room is located.

1. FLOOR Code – Numerical
   E. Exterior
   B. Basement
   1. 1st floor or main floor
   2. 2nd floor
   3. 3rd floor
   4. 4th floor

2. ROOM TYPE: Code – Alphabetical

Living Room	L	Verandah (front)	V
Dining Room	D	Sunroom	N
Kitchen	K	Recreation Room	R

Bedroom	B	Laundry Room	Q
Basement	I	Pantry	T
Furnace Room	F	Electrical Room & Workshop	E
Storage Room	S	Fruit Cellar	U
Washroom	W	Attic	A
Den	J	Vestibule	X
Hallway	H	Garage	G
Stairway	M	Other	Z
Porch	P	(specify in remarks column)	

When floor coding a stairway, to ensure continuity of coding always assume that you are about to ascend stairs and consider the stairway as part of the floor which you are on.

i.e. stairs—basement to first floor, assume stairs as part of basement code as B.

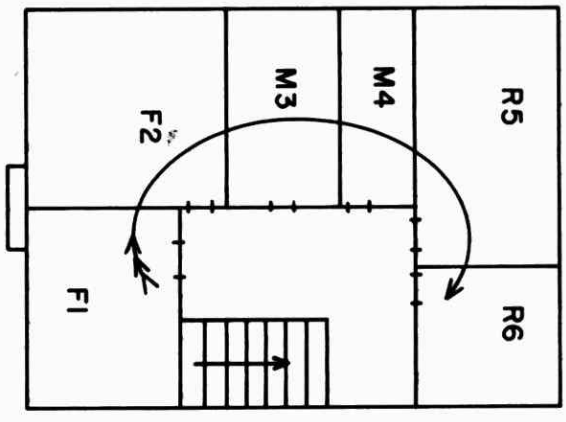
i.e. stairs—first floor to second floor, assume stairs as part of first floor code as 1, etc.

3. LOCATION: Code – Numerical and alphabetical

Adopt the clockwise direction starting with the front room on your right (ASSUMING THAT ALL COUNTING IS DONE WHILE STANDING OR IMAGINING THAT YOU ARE STANDING FACING THE FRONT OF THE BUILDING)

Hence rooms are numbered in a clockwise direction, and the alphabetical symbols differentiate rooms when there are two along the front rear or side.

F1 – Front 1
F2 – Front 2
M3 – Middle 3
M4 – Middle 4
R5 – Rear 5 etc. etc.



4. OCCUPANCY: Code – numerical

On the top of this sample page each occupant is listed on a separate line. This number is entered here to show that one specific person occupies the room in question.

i.e. If the occupants on the top are listed thus:

1 Mr. Mike Sloan
2 Mrs. Judith Sloan
3 Douglas Sloan
4 Iris Sloan

Summary: Assume that you will take a sample in a bedroom (code B) located on the second floor (Code 2) in the right corner (Code R6 as per diagram and the room is occupied by Douglas Sloan (Occupancy Code 3) and Iris Sloan (Occupancy Code 4)

The form would look thus:

Note: If you place a single digit code in a double digit code column, place a ZERO "0" in the unused column.

	Floor	Room Type	Location	Occupancy	
	2	B	R6	03	
				04	
	2	B	F2	01	
				02	

Coding

The next six columns identify the . . .
1. Sample No. numbered one to total no. of samples taken.
2. Sample type: i.e. paint, dust, water, soil, etc.
3. Item: exactly what did you take the sample from? Wall, door, stairs, railings, radiator, laundry tub, soil, etc.
4. Room directions: from which area of the room did you take a paint sample?
5. Preservative: indicate whether HNO_3 was added to the water sample.
6. Remarks: this is where a very detailed info is listed, info which could not be covered by a coding system.

Hence these next six columns tell you exactly what the number and type of sample you have collected: the item which you took the sample from and where that particular item is located: whether preservative is added and any very precise info that you deem necessary.

1. Sample No. Numerical
Samples labelled one to total no. of samples taken.

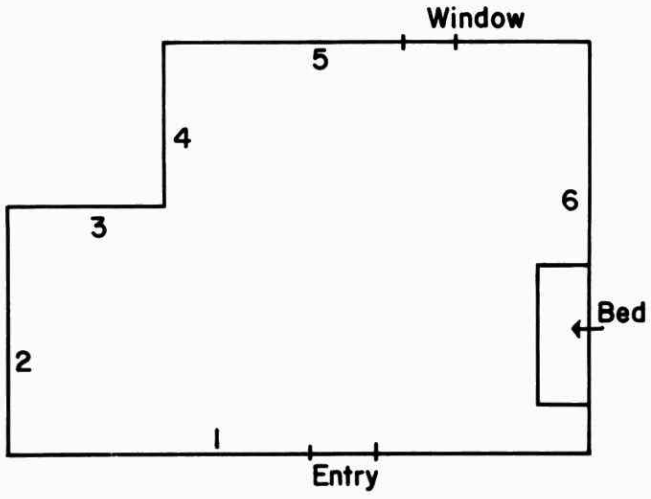
2. Sample Type. Numerical code
1. Paint
2. Dust—short term
3. Dust—long term
4. Wallpaper
5. Plaster
6. Soil 0-2″
7. Soil 2-4″
8. Water Cold—0 min.
9. Water Cold—10 min.
10. Water Hot—0 min.
11. Water Hot—running
12. Ceramics
13. Kettle water
14. Wine sample
15. Pickling liquid

3. Item. Numerical coding
1. Wall
2. Ceiling
3. Floor
4. Door interior
5. Door exterior
6. Door frame interior
7. Door frame exterior
8. Window frame interior
9. Windowsill frame exterior
11. Windowsill interior
12. Windowsill exterior
13. Area between inner and outer window
14. Baseboard
15. Stairs—Tread & Riser
16. Railing interior
17. Railing exterior
18. Kitchen cupboards
19. Highchair
21. Crib
22. Bed
23. Dresser
24. Fence
25. Children's toys interior
26. Children's toys exterior
27. Laundry tub
28. Kitchen sink
29. Hand basin
31. Isolated water tap
32. Bookcase
33. Chair
34. Table
35. Ceramics
36. Baseboard
37. Hot air duct
38. Cold air return duct
39. Radiator
41. Furnace
42. Vacuum cleaner
43. Bathtub
44. Light fixtures
45. Picture frames
46. Fireplace
47. Exterior Siding
48. Closet

61. Soil station No. 1 along rearmost boundary of property
62. Soil station No. 2 along rear wall of building
63. Soil station No. 3 front yard
64. Soil station No. 4 boulevard—(if there is one)
65. Soil station No. 5 street gutter dust & soil

4. Room Direction. Numerical code
Again due to the difficulty of not being able to adopt the points of the compass as reference points we must rely on a numbering system which can be interpreted *uniformly and consistently* by all staff members.

When entering any room or room unit which includes hallways etc. the wall through which you enter will always be No. 1. Then counting clockwise direction number wall to your left No. 2 etc. etc.



Assume your sample #5 will be of the paint on the inner window sill of this room.

CODING Sample #5
Sample type 1
Item 11
Rm direct. 5
Preserv. 0

Assume sample No. 6 will be of dust under the bed indicated (long term dust) therefore

Sample No. 6
Sample type 3
Item 3
Rm direct. 6
Preserv. Blank etc.

Preservative added. This applies to water samples only, and at the moment we add 20 drops of HNO_3 (Nitric Acid). Unless directed otherwise check this off since the acid will be added when samples are conveyed to the refrigerator.

Remarks—This is where very detailed information relating to samples taken can be entered: i.e. paint sample taken from a windowsill on which it is evident a child has been chewing indicated "evidence of chewing" i.e. paint sample taken from a door frame 24" up from floor the 24" up from floor can be indicated in this column.

Summary—Once you have established the *floor, room type, who occupies room, location* you are ready to sample. Sample 1 will be on the same line, Sample 2 will be entered in columns to the right, Sample 3 will be entered under Sample 1, etc. until you are finished in that particular room.

In the next room you again enter *floor, room type, location, occupancy* and begin to sample.

Identification of Samples

Always take your water samples first. Thus 0 minutes cold will always be sample No. 1, 10 minutes cold will always be No. 2; kettle water, if any, will be No. 3. Then carry on with paint, dust, soil etc.

Labelling

Water—label taped to outside of each bottle must contain the following information:

1 2 3 Doe Street
Water Sample Cold 0 Min.
Sample #1
20 drops HNO_3 added

Paint, dust, etc.—label (printed side out) is inserted in each sample vial containing the following information.

1 2 3 Doe Street
Paint
Sample #__

Soil—Label which is placed in a plastic label bag then together with the soil sample is sealed in the soil bag must contain the following information:

1 2 3 Doe Street
Soil 0-2"
Sample #__ Station #__

APPENDIX 8A

BREAKDOWN TO RESPONSES TO PART ONE EPIDEMIOLOGICAL SURVEY NON-NUMERIC QUESTIONS BY ADULT/CHILD/SEX GROUPS

Toronto Refiners and Smelters

Question	Response	Children								Adults							
		Male					Female			Male				Female			
		Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group		Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group		Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group		Mean Dist. (m)	S
		⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)			⩾40 (mcg/100mls)	<40 (mcg/100mls)			⩾40 (mcg/100mls)	<40 (mcg/100mls)		
Birthplace	Toronto	2	6	NSD	186	NSD	1	7	182	NSD	3	9	218	NSD	0	6	166	NSD
	Outside Toronto	5	5		149		2	10	223		5	15	227		0	18	195	
Previous Occup. Lead Exposure	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	2	5		—		3	5		—	0	0		—	0	1		—
Lead Worker (5 or 6) in House	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	6	8		—		3	13		—	7	17		—	0	21		—
Electric Kettle	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	0	0		—		0	0		—	0	0		—	0	0		—
History of Anemia	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	0	0		—		0	0		—	0	0		—	0	0		—
Do Others in House Smoke	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	0	0		—		0	0		—	0	0		—	0	0		—

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

Canada Metal

Question	Response	Children								Adults							
		Male					Female			Male				Female			
		Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group		Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group		Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group		Mean Dist. (m)	S
		⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)			⩾40 (mcg/100mls)	<40 (mcg/100mls)			⩾40 (mcg/100mls)	<40 (mcg/100mls)		
Birthplace	Toronto	20	60	NSD	356	NSD	12	74	*	363	NSD	8	38	NSD	278	NSD	1	58	NSD	319	NSD
	Outside Toronto	20	37		335		14	30		419		8	29		328		4	46		357	
Previous Occup. Lead Exposure	Yes	0	0	—	—	—	0	0	—	—	6	3	NSD	251	NSD	0	1	—	—	—
	No	9	28		—		15	38		—	2	5		193		0	9		—	
Lead Worker (5 or 6) in House	Yes	7	6	NSD	283	NSD	2	8	NSD	338	NSD	0	4	NSD	351	NSD	0	4	—	359	NSD
	No	30	72		361		24	74		406		16	44		299		5	74		343	
Electric Kettle	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	4	7		—		2	5		—	0	2		—	0	1		—
History of Anemia	Yes	0	0	—	—	—	0	0	—	—	0	0	—	—	0	0	—	—
	No	1	4		—		2	4		—	0	2		—	0	0		—
Do Others in House Smoke	Yes	0	3	—	—	—	2	5	NSD	307	NSD	1	2	—	—	—	1	3	—	—	—
	No	0	0		—		0	3		358		0	0		—		0	0		—	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

Prestolite

Question	Response	Children									Adults								
		Male					Female				Male					Female			
		Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S
		⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)	S		
Birthplace	Toronto	8	29	NSD	441	NSD	6	39	NSD	499	NSD	2	17	NSD	447	NSD	0	25	NSD	436	*
	Outside Toronto	27	52		516		14	54		521		6	18		536		1	44		526	
Previous Occup. Lead Exposure	Yes	0	1	NSD	—	—	0	1	NSD	—	—	0	0	—	—	—	0	2	—	313	**
	No	33	61		—		18	64		—		0	10		—		0	17		519	
Lead Worker (5 or 6) in House	Yes	2	2	NSD	344	***	1	3	NSD	453	NSD	2	1	NSD	388	*	0	4	NSD	395	NSD
	No	30	62		492		18	62		515		5	20		537		1	44		518	
Electric Kettle	Yes	0	0	—	—	—	0	0	—	—	—	0	0	—	—	—	0	0	—	—	—
	No	0	3		—		2	5		—		0	2		—		0	5		—	
History of Anemia	Yes	0	0	—	—	—	0	0	—	—	—	0	0	—	—	—	0	1	—	—	—
	No	1	4		—		2	5		—		0	2		—		0	3		—	
Do Others in House Smoke	Yes	0	8	—	451	NSD	1	10	NSD	414	NSD	0	1	—	—	—	0	1	—	—	—
	No	0	2		449		0	9		589		0	4		—		0	6		—	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

All Plant Areas Combined

Question	Response	Children									Adults								
		Male					Female				Male					Female			
		Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S	Number of Responses by Blood Lead Level Group			Mean Dist. (m)	S
		⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)	S			⩾40 (mcg/100mls)	<40 (mcg/100mls)	S		
Birthplace	Toronto	30	95	NSD	370	NSD	19	120	*	396	*	13	64	NSD	310	NSD	1	89	NSD	341	*
	Outside Toronto	52	94		420		30	94		456		19	62		365		5	108		398	
Previous Occup. Lead Exposure	Yes	0	1	NSD	—	—	0	1	NSD	—	—	6	3	*	251	*	0	3	—	—	—
	No	44	94		—		36	107		—		2	15		395		0	27		—	
Lead Worker (5 or 6) in House	Yes	9	8	NSD	297	**	3	11	NSD	371	NSD	2	5	NSD	367	NSD	0	8	NSD	377	NSD
	No	66	142		405		45	149		435		28	81		337		6	139		376	
Electric Kettle	Yes	0	0	—	—	—	0	0	—	—	—	0	0	—	—	—	0	0	—	—	—
	No	4	10		—		4	10		—		0	4		—		0	6		—	
History of Anemia	Yes	0	0	—	—	—	0	0	—	—	—	0	0	—	—	—	0	1	—	—	—
	No	2	8		—		4	9		—		0	4		—		0	3		—	
Do Others in House Smoke	Yes	0	11	—	—	—	3	15	NSD	372	NSD	1	3	NSD	326	NSD	1	4	NSD	309	*
	No	0	2		—		0	12		531		0	4		506		0	6		450	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level
NSD—No significant difference

APPENDIX 8B

BREAKDOWN TO RESPONSES TO PART ONE EPIDEMIOLOGICAL SURVEY NUMERIC QUESTIONS BY ADULT/CHILD/SEX GROUPS

Toronto Refiners and Smelters

Question	Blood Lead Level Group	Children								Adults							
		Male				Female				Male				Female			
		Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S
Length of Res. This House	⩾40	2.8	NSD	101	***	5.0	NSD	113	*	6.5	NSD	211	NSD	—	—	—	—
	<40	3.9		205		4.6		240		7.7		228		—		—	
Length of Res. Plant Area	⩾40	5.3	NSD	101	***	5.0	NSD	113	*	7.3	NSD	204	NSD	—	—	—	—
	<40	3.9		205		5.0		240		7.7		228		—		—	
Daily Hours At Residence	⩾40	18.7	NSD	101	***	20.3	NSD	113	*	16.0	NSD	204	NSD	—	—	—	—
	<40	19.9		205		19.8		240		15.0		223		—		—	
Daily Hours Working or School in Area	⩾40	4.8	NSD	101	***	5.5	NSD	89	*	10.0	NSD	188	NSD	—	—	—	—
	<40	4.7		204		5.0		287		10.0		205		—		—	
Daily Hours in Area	⩾40	23.5	NSD	101	***	24.0	NSD	113	*	20.3	*	204	NSD	—	—	—	—
	<40	23.9		205		22.5		240		16.3		223					
Number of Packs of Cigarettes Per Day Smoked	⩾40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<40	—		—		—		—		—		—		—		—	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level

Canada Metal

Question	Blood Lead Level Group	Children								Adults							
		Male				Female				Male				Female			
		Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S
Length of Res. This House	⩾40	4.1	NSD	325	NSD	4.1	*	413	NSD	16.8	NSD	271	NSD	15.0	NSD	410	NSD
	<40	4.7		357		6.3		419		13.4		307		13.6		339	
Length of Res. Plant Area	⩾40	4.3	NSD	329	NSD	4.1	**	434	NSD	16.8	NSD	271	NSD	15.0	NSD	410	NSD
	<40	4.9		372		6.4		416		13.3		316		13.1		346	
Daily Hours At Residence	⩾40	18.5	NSD	321	NSD	20.0	**	422	NSD	15.9	NSD	271	NSD	20.4	NSD	370	NSD
	<40	18.0		356		17.8		400		15.8		313		18.4		346	
Daily Hours Working or School in Area	⩾40	6.6	NSD	350	NSD	5.7	NSD	444	NSD	9.5	NSD	271	NSD	5.0	NSD	348	NSD
	<40	6.2		362		6.5		407		8.8		295		7.4		318	
Daily Hours in Area	⩾40	24.0	NSD	321	NSD	23.9	NSD	422	NSD	21.9	NSD	271	NSD	22.4	NSD	370	NSD
	<40	23.9		356		24.0		400		21.1		313		21.2		346	
Number of Packs of Cigarettes Per Day Smoked	⩾40	—	—	—	—	—	—	—	—	1.4	NSD	422	NSD	1.3	NSD	443	NSD
	<40	—		—		—		—		0.9		386		1.1		351	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level

Prestolite

Question	Blood Lead Level Group	Children								Adults							
		Male				Female				Male				Female			
		Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S
Length of Res. This House	⩾40	5.4	NSD	492	NSD	4.5	NSD	493	NSD	8.9	NSD	461	NSD	—	—	—	—
	<40	5.2		462		5.1		521		9.3		553		—		—	
Length of Res. Plant Area	⩾40	5.7	NSD	492	NSD	5.1	NSD	493	NSD	9.1	NSD	461	NSD	—	—	—	—
	<40	5.4		465		5.3		515		9.3		553		—		—	
Daily Hours At Residence	⩾40	16.1	NSD	522	NSD	18.7	*	500	NSD	13.8	NSD	459	NSD	—	—	—	—
	<40	16.6		470		16.2		518		13.5		529		—		—	
Daily Hours Working or School in Area	⩾40	8.1	NSD	507	NSD	6.8	NSD	548	NSD	—	—	—	—	—	—	—	—
	<40	7.9		449		8.3		518		—		—		—		—	
Daily Hours in Area	⩾40	23.4	NSD	522	NSD	23.5	NSD	500	NSD	13.8	NSD	459	NSD	—	—	—	—
	<40	23.3		470		23.6		518		15.9		529		—		—	
Number of Packs of Cigarettes Per Day Smoked	⩾40	—	—	—	—	—	—	—	—	1.1	NSD	474	—	—	—	—	—
	<40	—		—		—		—		1.0		514		—		—	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level

All Plant Areas Combined

Question	Blood Lead Level Group	Children								Adults							
		Male				Female				Male				Female			
		Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S	Mean Result	S	Mean Dist.	S
Length of Res. This House	⩾40	4.6	NSD	378	NSD	4.4	*	425	NSD	12.7	NSD	305	NSD	12.8	NSD	421	NSD
	<40	4.9		396		5.6		445		11.4		354		10.6		375	
Length of Res. Plant Area	⩾40	5.1	NSD	378	NSD	4.6	*	435	NSD	12.8	NSD	300	NSD	12.8	NSD	421	NSD
	<40	5.0		404		5.8		442		11.4		359		10.4		377	
Daily Hours At Residence	⩾40	17.5	NSD	388	NSD	19.5	***	430	NSD	15.6	NSD	288	NSD	21.0	NSD	386	NSD
	<40	17.5		398		17.3		435		15.0		351		19.3		373	
Daily Hours Working or School in Area	⩾40	7.1	NSD	395	NSD	6.1	*	460	NSD	9.6	NSD	252	NSD	5.0	NSD	348	NSD
	<40	6.8		391		7.2		446		9.0		312		7.5		309	
Daily Hours in Area	⩾40	23.7	NSD	388	NSD	23.8	NSD	430	NSD	20.0	NSD	288	NSD	22.7	NSD	386	NSD
	<40	23.7		398		23.7		435		18.7		351		21.0		373	
Number of Packs of Cigarettes Per Day Smoked	⩾40	—	—	—	—	—	—	—	—	1.3	NSD	448	NSD	1.3	NSD	443	NSD
	<40	—		—		—		—		0.9		431		1.0		376	

S—Significance
*Significant at 5% level
**Significant at 1% level
***Significant at 0.1% level

APPENDIX 8C

RESULTS OF REGRESSION ANALYSIS OF BLOOD LEAD LEVELS VS. CITY OF TORONTO SAMPLE RESULTS FOR EACH AGE AND SEX GROUP

Toronto Refiners and Smelters

Male—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00088	0.00042		15
Paint—Inaccessible Surfaces	0.00023	0.00018		14
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner				
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.01761	0.00591	*	8
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	0.01466	0.00220	***	11
Wallpaper				
Plaster—Accessible				
Topsoil	–0.00271	0.00129		6
Subsoil	–0.00293	0.00095	*	6
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	1035.14	540.85		11
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Toronto Refiners and Smelters

Female—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00073	0.00029	*	16
Paint—Inaccessible Surfaces	0.00031	0.00010	*	14
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner	0.00345	0.00132	*	8
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.02480	0.00722	*	7
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	0.00699	0.00114	***	10
Wallpaper				
Plaster—Accessible				
Topsoil	0.00110	0.00067		10
Subsoil	0.00154	0.00144		10
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	831.05	481.07		8
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Toronto Refiners and Smelters

Children—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00083	0.00027	**	31
Paint—Inaccessible Surfaces	0.00026	0.00011	*	28
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner	0.00399	0.00121	*	10
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.01664	0.00400	**	15
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	0.01254	0.00165	***	21
Wallpaper				
Plaster—Accessible				
Topsoil	0.00210	0.00074	*	16
Subsoil	0.00170	0.00170		16
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	657.82	422.90		19
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Toronto Refiners and Smelters

Adults—Male

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00008	0.00020		27
Paint—Inaccessible Surfaces	–0.00006	0.00005		26
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner	–0.00592	0.00233	*	8
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.00041	0.00178		15
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	0.00425	0.00207		19
Wallpaper				
Plaster—Accessible				
Topsoil	0.00097	0.00154		17
Subsoil	0.01261	0.00631		17
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	313.11	291.29		16
Cold Water—Bathroom	1346.11	1192.38		6
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Toronto Refiners and Smelters

Female—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00030	0.00018		19
Paint—Inaccessible Surfaces	0.00010	0.00006		18
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner	0.00630	0.00185	*	7
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.00127	0.00253		10
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	0.00379	0.00141	*	12
Wallpaper				
Plaster—Accessible				
Topsoil	0.00140	0.00085		12
Subsoil	0.00156	0.00188		12
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	392.93	318.03		10
Cold Water—Bathroom	130.34	120.87		4
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Toronto Refiners and Smelters

Adults—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00023	0.00014		46
Paint—Inaccessible Surfaces	0.00001	0.00004		44
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor				
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner	0.00159	0.00262		15
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor				
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible	0.00340	0.00160	*	31
Wallpaper				
Plaster—Accessible				
Topsoil	0.00118	0.00088		29
Subsoil	0.00173	0.00215		29
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	314.05	203.45		26
Cold Water—Bathroom	285.69	840.19		10
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink				
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Canada Metal

Male—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00006	0.00003		135
Paint—Inaccessible Surfaces	0.0	0.00002		86
Paint—From Floor	0.00019	0.00014		9
S.T. Dust—Miscellaneous Accessible	0.00619	0.00336		6
S.T. Dust—From Floor	–0.00006	0.00009		53
S.T. Dust—From Windowsill	–0.00015	0.00104		7
S.T. Dust—From Vacuum Cleaner	–0.00307	0.00173		14
L.T. Dust—Miscellaneous Accessible	0.00089	0.00102		16
L.T. Dust—From Floor	–0.00001	0.00020		74
L.T. Dust—From Windowsill	0.00047	0.00025		40
L.T. Dust—Inaccessible	–0.00024	0.00040		93
Wallpaper	0.00023	0.00088		13
Plaster—Accessible	0.00052	0.00019	*	21
Topsoil	0.00207	0.00222		73
Subsoil	0.00115	0.00204		60
Cold Water—Laundry Tub	–34.99	79.40		62
Cold Water—Kitchen Sink	–83.46	73.02		66
Cold Water—Bathroom	–2.48	63.09		9
Cold Water—Running from Laundry Tub	–89.50	117.03		26
Cold Water—Running from Kitchen Sink	–159.44	84.43		51
Cold Water—Running from Bathroom	–13.73	414.23		5
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Canada Metal

Female—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00002	0.00004		128
Paint—Inaccessible Surfaces	–0.00001	0.00002		83
Paint—From Floor	–0.0	0.00007		12
S.T. Dust—Miscellaneous Accessible	0.00069	0.00198		9
S.T. Dust—From Floor	0.00042	0.00025		41
S.T. Dust—From Windowsill	–0.00245	0.00165		5
S.T. Dust—From Vacuum Cleaner	0.00025	0.00240		16
L.T. Dust—Miscellaneous Accessible	0.00006	0.00089		15
L.T. Dust—From Floor	–0.00009	0.00016		79
L.T. Dust—From Windowsill	0.00010	0.00033		54
L.T. Dust—Inaccessible	0.00001	0.00026		94
Wallpaper	0.00040	0.00096		15
Plaster—Accessible	–0.00005	0.00022		21
Topsoil	–0.00305	0.00235		77
Subsoil	–0.00021	0.00254		57
Cold Water—Laundry Tub	72.49	73.06		50
Cold Water—Kitchen Sink	–48.70	44.86		61
Cold Water—Bathroom	–42.01	58.38		17
Cold Water—Running from Laundry Tub	–77.07	60.91		27
Cold Water—Running from Kitchen Sink	–84.69	41.95	*	48
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Canada Metal

Children—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00003	0.00002		263
Paint—Inaccessible Surfaces	–0.0	0.00001		169
Paint—From Floor	0.00012	0.00008		21
S.T. Dust—Miscellaneous Accessible	0.00506	0.00261		15
S.T. Dust—From Floor	–0.00001	0.00008		94
S.T. Dust—From Windowsill	–0.00027	0.00079		12
S.T. Dust—From Vacuum Cleaner	–0.00105	0.00144		30
L.T. Dust—Miscellaneous Accessible	0.00055	0.00063		31
L.T. Dust—From Floor	–0.00006	0.00013		153
L.T. Dust—From Windowsill	0.00034	0.00020		94
L.T. Dust—Inaccessible	–0.00014	0.00023		187
Wallpaper	0.00019	0.00059		28
Plaster—Accessible	0.00033	0.00014	*	42
Topsoil	0.00045	0.00162		150
Subsoil	0.00083	0.00159		117
Cold Water—Laundry Tub	15.51	53.70		112
Cold Water—Kitchen Sink	–66.06	39.93		127
Cold Water—Bathroom	–20.92	38.84		26
Cold Water—Running from Laundry Tub	–75.81	49.35		53
Cold Water—Running from Kitchen Sink	–121.23	43.26	**	99
Cold Water—Running from Bathroom	–373.22	408.34		8
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Canada Metal

Male—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00013	0.00004	**	79
Paint—Inaccessible Surfaces	0.00005	0.00002		45
Paint—From Floor	0.00013	0.00030		8
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor	–0.00004	0.00033		24
S.T. Dust—From Windowsill	–0.00629	0.00273		6
S.T. Dust—From Vacuum Cleaner	–0.00256	0.00143		18
L.T. Dust—Miscellaneous Accessible	–0.00127	0.00061		12
L.T. Duwt—From Floor	–0.00036	0.00022		46
L.T. Dust—From Windowsill	–0.00007	0.00008		24
L.T. Dust—Inaccessible	0.00157	0.00068	*	58
Wallpaper	–0.00031	0.00100		8
Plaster—Accessible	0.00024	0.00024		15
Topsoil	0.00106	0.00199		39
Subsoil	0.00431	0.00262		21
Cold Water—Laundry Tub	104.35	95.49		36
Cold Water—Kitchen Sink	–184.17	135.20		41
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub	–840.20	267.45	**	24
Cold Water—Running from Kitchen Sink	–44.97	62.12		35
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Canada Metal

Female—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.0	0.00004		105
Paint—Inaccessible Surfaces	0.00001	0.00002		66
Paint—From Floor	–0.00018	0.00025		11
S.T. Dust—Miscellaneous Accessible	0.00254	0.00837		5
S.T. Dust—From Floor	–0.00008	0.00041		29
S.T. Dust—From Windowsill	–0.00061	0.00111		7
S.T. Dust—From Vacuum Cleaner	–0.00002	0.00113		20
L.T. Dust—Miscellaneous Accessible	–0.00071	0.00054		10
L.T. Dust—From Floor	–0.00009	0.00008		69
L.T. Dust—From Windowsill	–0.00003	0.00006		37
L.T. Dust—Inaccessible	0.00033	0.00032		75
Wallpaper	0.00026	0.00068		11
Plaster—Accessible	0.00039	0.00049		19
Topsoil	0.00089	0.00229		50
Subsoil	0.00209	0.00263		33
Cold Water—Laundry Tub	219.97	74.43	**	48
Cold Water—Kitchen Sink	–11.33	97.00		53
Cold Water—Bathroom	–144.82	26.99	**	6
Cold Water—Running from Laundry Tub	15.57	153.80		32
Cold Water—Running from Kitchen Sink	–22.08	49.25		44
Cold Water—Running from Bathroom	–941.77	129.06	*	4
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Canada Metal

Adults—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00006	0.00003	*	184
Paint—Inaccessible Surfaces	0.00003	0.00001		111
Paint—From Floor	0.00009	0.00015		19
S.T. Dust—Miscellaneous Accessible	–0.00505	0.00321		7
S.T. Dust—From Floor	–0.00009	0.00026		53
S.T. Dust—From Windowsill	–0.00265	0.00144		13
S.T. Dust—From Vacuum Cleaner	–0.00022	0.00121		38
L.T. Dust—Miscellaneous Accessible	–0.00103	0.00045	*	22
L.T. Dust—From Floor	–0.00016	0.00008	*	115
L.T. Dust—From Windowsill	–0.00004	0.00006		61
L.T. Dust—Inaccessible	0.00041	0.00030		133
Wallpaper	–0.00001	0.00075		19
Plaster—Accessible	0.00031	0.00018		34
Topsoil	0.00084	0.00158		89
Subsoil	0.00373	0.00186		54
Cold Water—Laundry Tub	169.27	63.28	**	84
Cold Water—Kitchen Sink	–101.06	83.82		94
Cold Water—Bathroom	–96.60	43.55		9
Cold Water—Running from Laundry Tub	–379.74	169.48	*	56
Cold Water—Running from Kitchen Sink	–34.29	40.16		79
Cold Water—Running from Bathroom	–546.49	669.41		6
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Prestolite

Male—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00006	0.00004		109
Paint—Inaccessible Surfaces	–0.00001	0.00004		22
Paint—From Floor	–0.00660	0.00259		6
S.T. Dust—Miscellaneous Accessible	0.00126	0.00227		21
S.T. Dust—From Floor	–0.00002	0.00006		33
S.T. Dust—From Windowsill	–0.00027	0.00019		5
S.T. Dust—From Vacuum Cleaner	0.00475	0.00512		22
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.00015	0.00256		23
L.T. Dust—From Windowsill	–0.00364	0.00181		7
L.T. Dust—Inaccessible	0.00017	0.00107		93
Wallpaper				
Plaster—Accessible	–0.00159	0.00284		7
Topsoil	–0.00187	0.00285		28
Subsoil	–0.00296	0.00588		23
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	192.47	118.65		111
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	406.95	178.14	*	109
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	465.88	365.82		33
Hot Water—Running from Kitchen Sink	371.77	404.23		30
Kettle Water	–44.88	21.53		3

Prestolite

Female—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.0	0.00003		110
Paint—Inaccessible Surfaces	0.00003	0.00003		40
Paint—From Floor	–0.00005	0.00010		13
S.T. Dust—Miscellaneous Accessible	0.00014	0.00180		17
S.T. Dust—From Floor	0.00035	0.00009	***	29
S.T. Dust—From Windowsill	–0.00004	0.00018		14
S.T. Dust—From Vacuum Cleaner	0.00022	0.00347		35
L.T. Dust—Miscellaneous Accessible	–0.00710	0.01166		10
L.T. Dust—From Floor	–0.00522	0.00383		18
L.T. Dust—From Windowsill	–0.00265	0.00577		10
L.T. Dust—Inaccessible	0.00053	0.00033		92
Wallpaper				
Plaster—Accessible	0.00308	0.00114	*	11
Topsoil	0.01707	0.00473	**	31
Subsoil	0.00246	0.00247		24
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	66.52	82.34		97
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	316.10	184.84		96
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	–1475.79	466.46	**	19
Hot Water—Running from Kitchen Sink	–1205.41	425.25	*	19
Kettle Water	206.14	166.33		5

Prestolite

Children—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00003	0.00002		219
Paint—Inaccessible Surfaces	0.00001	0.00003		62
Paint—From Floor	–0.00006	0.00007		19
S.T. Dust—Miscellaneous Accessible	0.00007	0.00170		38
S.T. Dust—From Floor	0.00011	0.00005	*	62
S.T. Dust—From Windowsill	0.00003	0.00014		19
S.T. Dust—From Vacuum Cleaner	0.00122	0.00282		57
L.T. Dust—Miscellaneous Accessible	0.01265	0.00866		13
L.T. Dust—From Floor	–0.00176	0.00203		41
L.T. Dust—From Windowsill	–0.00275	0.00241		17
L.T. Dust—Inaccessible	0.00049	0.00031		185
Wallpaper				
Plaster—Accessible	0.00168	0.00126		18
Topsoil	0.00144	0.00234		59
Subsoil	0.00080	0.00288		47
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	103.30	69.03		208
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	389.78	128.76	**	205
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	78.72	306.12		52
Hot Water—Running from Kitchen Sink	–123.11	308.75		49
Kettle Water	4.57	29.82		10

Prestolite

Male—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00007	0.00008		41
Paint—Inaccessible Surfaces	–0.00010	0.00010		16
Paint—From Floor	0.00031	0.00015		8
S.T. Dust—Miscellaneous Accessible	–0.00297	0.01378		4
S.T. Dust—From Floor	–0.00049	0.00169		10
S.T. Dust—From Windowsill	0.00053	0.00113		4
S.T. Dust—From Vacuum Cleaner	–0.00549	0.00512		12
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	–0.00952	0.04170		5
L.T. Dust—From Windowsill	–0.00743	0.01682		5
L.T. Dust—Inaccessible	0.00146	0.00261		33
Wallpaper				
Plaster—Accessible				
Topsoil	–0.00829	0.00650		13
Subsoil	–0.00613	0.00619		11
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	172.79	151.92		39
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	283.47	323.68		39
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	–447.50	1580.98		8
Hot Water—Running from Kitchen Sink	–804.28	1005.81		8
Kettle Water	132.31	0.30	***	4

Prestolite

Female—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00005	0.00005		67
Paint—Inaccessible Surfaces	–0.00005	0.00007		17
Paint—From Floor	–0.00017	0.00020		7
S.T. Dust—Miscellaneous Accessible	0.00049	0.00125		12
S.T. Dust—From Floor	0.00008	0.00004		19
S.T. Dust—From Windowsill	–0.00034	0.00035		6
S.T. Dust—From Vacuum Cleaner	0.00041	0.00392		18
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	0.00664	0.00594		12
L.T. Dust—From Windowsill	–0.00022	0.00169		7
L.T. Dust—Inaccessible	–0.00052	0.00122		59
Wallpaper				
Plaster—Accessible	0.00052	0.00428		6
Topsoil	0.00088	0.00463		14
Subsoil	0.01335	0.00738		11
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	72.77	78.92		63
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	76.29	177.07		62
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	186.42	214.46		18
Hot Water—Running from Kitchen Sink	45.98	219.65		17
Kettle Water	–82.94	185.98		4

Prestolite

Adults—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00002	0.00005		108
Paint—Inaccessible Surfaces	–0.00006	0.00007		33
Paint—From Floor	0.00028	0.00011	*	15
S.T. Dust—Miscellaneous Accessible	0.00074	0.00277		16
S.T. Dust—From Floor	0.00002	0.00011		29
S.T. Dust—From Windowsill	–0.00034	0.00036		10
S.T. Dust—From Vacuum Cleaner	0.00131	0.00336		30
L.T. Dust—Miscellaneous Accessible	–0.00328	0.00308		5
L.T. Dust—From Floor	0.00271	0.00576		17
L.T. Dust—From Windowsill	–0.00261	0.00231		12
L.T. Dust—Inaccessible	0.00040	0.00130		92
Wallpaper				
Plaster—Accessible	–0.00714	0.00637		9
Topsoil	–0.00443	0.00444		27
Subsoil	–0.00238	0.00506		22
Cold Water—Laundry Tub				
Cold Water—Kitchen Sink	88.74	83.24		102
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub				
Cold Water—Running from Kitchen Sink	129.96	182.36		101
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	461.80	382.98		26
Hot Water—Running from Kitchen Sink	200.91	347.15		25
Kettle Water	96.06	108.68		8

Control Area

Male—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00001	0.00001		133
Paint—Inaccessible Surfaces	–0.0	.0.00001		55
Paint—From Floor	0.00058	0.00051		8
S.T. Dust—Miscellaneous Accessible	–0.00043	0.00031		20
S.T. Dust—From Floor	–0.00018	0.00012		33
S.T. Dust—From Windowsill	–0.00003	0.00002		24
S.T. Dust—From Vacuum Cleaner	–0.00619	0.00294		10
L.T. Dust—Miscellaneous Accessible	0.00066	0.00075		22
L.T. Dust—From Floor	–0.00003	0.00007		49
L.T. Dust—From Windowsill	–0.00002	0.00003		29
L.T. Dust—Inaccessible	0.00004	0.00019		52
Wallpaper	–0.00016	0.00011		48
Plaster—Accessible	0.00006	0.00006		41
Topsoil				
Subsoil				
Cold Water—Laundry Tub	44.31	44.10		56
Cold Water—Kitchen Sink	–19.84	46.89		72
Cold Water—Bathroom	105.18	69.96		7
Cold Water—Running from Laundry Tub	–133.06	115.81		52
Cold Water—Running from Kitchen Sink	–41.61	62.75		73
Cold Water—Running from Bathroom	216.57	270.99		7
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water	–16.38	29.44		18

Control Area

Female—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00001	0.00001		114
Paint—Inaccessible Surfaces	–0.00001	0.00001		51
Paint—From Floor	0.00066	0.00016	**	13
S.T. Dust—Miscellaneous Accessible	–0.00019	0.00034		17
S.T. Dust—From Floor	–0.00083	0.00045		26
S.T. Dust—From Windowsill	–0.00012	0.00007		16
S.T. Dust—From Vacuum Cleaner	–0.00382	0.00405		14
L.T. Dust—Miscellaneous Accessible	0.00007	0.00045		14
L.T. Dust—From Floor	–0.00017	0.00019		60
L.T. Dust—From Windowsill	0.0	0.00001		34
L.T. Dust—Inaccessible	–0.00001	0.00014		50
Wallpaper	–0.00009	0.00011		40
Plaster—Accessible	–0.00026	0.00033		38
Topsoil				
Subsoil				
Cold Water—Laundry Tub	9.52	18.19		44
Cold Water—Kitchen Sink	–10.51	31.45		60
Cold Water—Bathroom	–6.26	47.49		11
Cold Water—Running from Laundry Tub	14.17	83.32		43
Cold Water—Running from Kitchen Sink	16.63	66.66		61
Cold Water—Running from Bathroom	32.35	178.78		11
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water	–27.90	24.54		14

Control Area

Children—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00001	0.00001		247
Paint—Inaccessible Surfaces	–0.00001	0.00001		106
Paint—From Floor	0.00063	0.00017	**	21
S.T. Dust—Miscellaneous Accessible	–0.00031	0.00022		37
S.T. Dust—From Floor	–0.00019	0.00010		59
S.T. Dust—From Windowsill	–0.00002	0.00001		40
S.T. Dust—From Vacuum Cleaner	–0.00340	0.00240		24
L.T. Dust—Miscellaneous Accessible	0.00009	0.00035		36
L.T. Dust—From Floor	–0.00003	0.00006		109
L.T. Dust—From Windowsill	–0.00001	0.00001		63
L.T. Dust—Inaccessible	0.00001	0.00012		102
Wallpaper	–0.00013	0.00008		88
Plaster—Accessible	0.00005	0.00005		79
Topsoil				
Subsoil				
Cold Water—Laundry Tub	7.05	17.14		100
Cold Water—Kitchen Sink	–15.68	26.29		132
Cold Water—Bathroom	34.85	37.10		18
Cold Water—Running from Laundry Tub	–60.63	69.60		95
Cold Water—Running from Kitchen Sink	–18.48	45.20		134
Cold Water—Running from Bathroom	124.45	126.92		18
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water	–23.05	20.29		32

Control Area

Male—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00004	0.00004		9
Paint—Inaccessible Surfaces				
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible				
S.T. Dust—From Floor	0.00021	0.00005	*	4
S.T. Dust—From Windowsill				
S.T. Dust—From Vacuum Cleaner				
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor				
L.T. Dust—From Windowsill				
L.T. Dust—Inaccessible				
Wallpaper	0.00054	0.00071		6
Plaster—Accessible	–0.00655	0.00200		4
Topsoil				
Subsoil				
Cold Water—Laundry Tub	180.18	1804.72		4
Cold Water—Kitchen Sink	271.19	281.07		4
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub	2835.87	472.97	*	4
Cold Water—Running from Kitchen Sink	286.48	98.68		4
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water				

Control Area

Female—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00001	0.00002		29
Paint—Inaccessible Surfaces	–0.00002	0.00003		9
Paint—From Floor				
S.T. Dust—Miscellaneous Accessible	–0.00064	0.00022		5
S.T. Dust—From Floor	–0.00018	0.00010		10
S.T. Dust—From Windowsill	–0.00006	0.00003		4
S.T. Dust—From Vacuum Cleaner	–0.00895	0.02121		7
L.T. Dust—Miscellaneous Accessible				
L.T. Dust—From Floor	–0.00006	0.00010		15
L.T. Dust—From Windowsill	0.00003	0.00002		6
L.T. Dust—Inaccessible	–0.00005	0.00020		15
Wallpaper	0.00006	0.00015		11
Plaster—Accessible	0.00002	0.00006		7
Topsoil				
Subsoil				
Cold Water—Laundry Tub	105.73	31.43	**	15
Cold Water—Kitchen Sink	29.24	109.28		13
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub	804.87	381.15		15
Cold Water—Running from Kitchen Sink	21.44	208.67		13
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water	–24.91	23.97		4

Control Area

Adults—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00001	0.00002		38
Paint—Inaccessible Surfaces	–0.00001	0.00004		11
Paint—From Floor	–0.00038	0.00025		5
S.T. Dust—Miscellaneous Accessible	–0.00063	0.00019	*	6
S.T. Dust—From Floor	–0.00003	0.00013		14
S.T. Dust—From Windowsill	–0.00002	0.00003		6
S.T. Dust—From Vacuum Cleaner	–0.00436	0.01986		8
L.T. Dust—Miscellaneous Accessible	–0.03335	0.01170		4
L.T. Dust—From Floor	–0.00008	0.00010		18
L.T. Dust—From Windowsill	–0.0	0.00004		7
L.T. Dust—Inaccessible	–0.00005	0.00020		18
Wallpaper	0.00005	0.00019		17
Plaster—Accessible	–0.00002	0.00007		11
Topsoil				
Subsoil				
Cold Water—Laundry Tub	86.83	36.10	*	19
Cold Water—Kitchen Sink	40.31	90.35		17
Cold Water—Bathroom				
Cold Water—Running from Laundry Tub	875.99	349.84	*	19
Cold Water—Running from Kitchen Sink	94.13	148.60		17
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink				
Hot Water—Running from Kitchen Sink				
Kettle Water	–24.91	23.97		4

All Areas

Male—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00003	0.00001		392
Paint—Inaccessible Surfaces	–0.00001	0.00001		177
Paint—From Floor	0.00019	0.00011		25
S.T. Dust—Miscellaneous Accessible	–0.00018	0.00085		47
S.T. Dust—From Floor	–0.00006	0.00005		119
S.T. Dust—From Windowsill	–0.00005	0.00002	*	36
S.T. Dust—From Vacuum Cleaner	0.00116	0.00152		48
L.T. Dust—Miscellaneous Accessible	0.00066	0.00069		42
L.T. Dust—From Floor	–0.00003	0.00010		154
L.T. Dust—From Windowsill	–0.00002	0.00005		79
L.T. Dust—Inaccessible	0.00001	0.00023		249
Wallpaper	–0.00018	0.00018		64
Plaster—Accessible	0.00016	0.00011		72
Topsoil	0.00199	0.00072	**	107
Subsoil	0.00300	0.00124	*	89
Cold Water—Laundry Tub	60.37	51.22		125
Cold Water—Kitchen Sink	24.30	53.17		260
Cold Water—Bathroom	40.20	43.06		18
Cold Water—Running from Laundry Tub	–43.51	81.49		80
Cold Water—Running from Kitchen Sink	–10.77	64.40		236
Cold Water—Running from Bathroom	93.34	278.56		12
Hot Water—Kitchen Sink	468.23	360.61		34
Hot Water—Running from Kitchen Sink	376.64	405.86		32
Kettle Water	17.93	16.59		23

All Areas

Female—Children

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00002	0.00001		368
Paint—Inaccessible Surfaces	0.0	0.00001		188
Paint—From Floor	–0.00002	0.00005		41
S.T. Dust—Miscellaneous Accessible	–0.00022	0.00044		43
S.T. Dust—From Floor	0.00035	0.00009	***	96
S.T. Dust—From Windowsill	–0.00014	0.00010		35
S.T. Dust—From Vacuum Cleaner	0.00271	0.00122	*	73
L.T. Dust—Miscellaneous Accessible	–0.00020	0.00042		40
L.T. Dust—From Floor	0.0	0.00014		164
L.T. Dust—From Windowsill	–0.00003	0.00003		99
L.T. Dust—Inaccessible	0.00019	0.00016		246
Wallpaper	–0.00014	0.00019		57
Plaster—Accessible	0.00025	0.00019		71
Topsoil	0.00141	0.00085		118
Subsoil	0.00314	0.00137	*	91
Cold Water—Laundry Tub	–4.70	27.24		105
Cold Water—Kitchen Sink	–3.16	32.69		226
Cold Water—Bathroom	–2.01	49.94		29
Cold Water—Running from Laundry Tub	–45.55	46.75		74
Cold Water—Running from Kitchen Sink	–14.06	42.50		207
Cold Water—Running from Bathroom	–113.84	389.87		14
Hot Water—Kitchen Sink	–1502.17	456.88	**	21
Hot Water—Running from Kitchen Sink	–1199.90	423.42	*	20
Kettle Water	–19.36	33.31		19

All Areas

Children—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00002	0.00001	*	760
Paint—Inaccessible Surfaces	0.0	0.00001		365
Paint—From Floor	0.00002	0.00005		66
S.T. Dust—Miscellaneous Accessible	–0.00026	0.00053		90
S.T. Dust—From Floor	0.00004	0.00004		215
S.T. Dust—From Windowsill	–0.00004	0.00002		71
S.T. Dust—From Vacuum Cleaner	0.00210	0.00095	*	121
L.T. Dust—Miscellaneous Accessible	0.00010	0.00037		82
L.T. Dust—From Floor	–0.00002	0.00008		318
L.T. Dust—From Windowsill	–0.00003	0.00002		178
L.T. Dust—Inaccessible	0.00009	0.00013		495
Wallpaper	–0.00016	0.00013		121
Plaster—Accessible	0.00018	0.00009	*	143
Topsoil	0.00205	0.00055	***	225
Subsoil	0.00322	0.00093	**	180
Cold Water—Laundry Tub	6.35	24.40		230
Cold Water—Kitchen Sink	–1.01	29.37		486
Cold Water—Bathroom	18.95	32.30		47
Cold Water—Running from Laundry Tub	–45.55	38.48		154
Cold Water—Running from Kitchen Sink	–16.44	37.44		443
Cold Water—Running from Bathroom	–17.45	219.26		26
Hot Water—Kitchen Sink	87.65	305.01		55
Hot Water—Running from Kitchen Sink	–129.41	307.03		52
Kettle Water	18.60	14.28		42

All Areas

Male—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.00006	0.00003	*	156
Paint—Inaccessible Surfaces	0.00003	0.00002		89
Paint—From Floor	0.00022	0.00011		19
S.T. Dust—Miscellaneous Accessible	–0.00527	0.00566		7
S.T. Dust—From Floor	–0.00005	0.00027		38
S.T. Dust—From Windowsill	–0.00013	0.00006		12
S.T. Dust—From Vacuum Cleaner	–0.00114	0.00127		39
L.T. Dust—Miscellaneous Accessible	–0.00031	0.00081		19
L.T. Dust—From Floor	0.00043	0.00031		69
L.T. Dust—From Windowsill	–0.00002	0.00008		31
L.T. Dust—Inaccessible	0.00188	0.00067	**	113
Wallpaper	0.00003	0.00075		18
Plaster—Accessible	0.00017	0.00034		23
Topsoil	0.00122	0.00105		69
Subsoil	0.00443	0.00199	*	49
Cold Water—Laundry Tub	142.39	92.41		44
Cold Water—Kitchen Sink	75.10	91.95		100
Cold Water—Bathroom	1.36	111.16		10
Cold Water—Running from Laundry Tub	–628.18	278.70	*	29
Cold Water—Running from Kitchen Sink	–28.67	66.76		83
Cold Water—Running from Bathroom				
Hot Water—Kitchen Sink	–447.50	1580.98		8
Hot Water—Running from Kitchen Sink	–804.78	1005.81		8
Kettle Water	132.31	0.30	***	4

All Areas

Female—Adults

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	–0.00003	0.00002		220
Paint—Inaccessible Surfaces	0.00002	0.00002		110
Paint—From Floor	–0.00012	0.00014		25
S.T. Dust—Miscellaneous Accessible	–0.00057	0.00047		22
S.T. Dust—From Floor	0.00001	0.00007		58
S.T. Dust—From Windowsill	–0.00008	0.00004		17
S.T. Dust—From Vacuum Cleaner	0.00200	0.00101		52
L.T. Dust—Miscellaneous Accessible	–0.00044	0.00047		17
L.T. Dust—From Floor	–0.00008	0.00007		106
L.T. Dust—From Windowsill	0.0	0.00003		51
L.T. Dust—Inaccessible	0.00009	0.00016		161
Wallpaper	–0.00007	0.00017		25
Plaster—Accessible	–0.00005	0.00008		33
Topsoil	0.00112	0.00075		76
Subsoil	0.00243	0.00135		56
Cold Water—Laundry Tub	93.08	34.34	**	67
Cold Water—Kitchen Sink	93.95	54.50		139
Cold Water—Bathroom	–18.83	46.84		12
Cold Water—Running from Laundry Tub	235.33	165.40		47
Cold Water—Running from Kitchen Sink	23.91	46.71		121
Cold Water—Running from Bathroom	–537.58	595.57		6
Hot Water—Kitchen Sink	186.42	214.46		18
Hot Water—Running from Kitchen Sink	33.13	217.19		18
Kettle Water	1.20	45.11		8

All Areas

Adults—All

Type of Result	Regression Coefficient	Standard Error	Significance	No. of Cases
Paint—Accessible Surfaces	0.0	0.00002		376
Paint—Inaccessible Surfaces	0.00003	0.00001		199
Paint—From Floor	0.00018	0.00008	*	44
S.T. Dust—Miscellaneous Accessible	–0.00090	0.00107		29
S.T. Dust—From Floor	–0.00002	0.00008		96
S.T. Dust—From Windowsill	–0.00011	0.00004	*	29
S.T. Dust—From Vacuum Cleaner	0.00134	0.00093		91
L.T. Dust—Miscellaneous Accessible	–0.00034	0.00051		36
L.T. Dust—From Floor	–0.00013	0.00007		175
L.T. Dust—From Windowsill	–0.00001	0.00004		82
L.T. Dust—Inaccessible	0.00011	0.00018		274
Wallpaper	–0.00019	0.00024		43
Plaster—Accessible	–0.00001	0.00012		56
Topsoil	0.00110	0.00065		145
Subsoil	0.00309	0.00120	*	105
Cold Water—Laundry Tub	84.00	34.84	*	111
Cold Water—Kitchen Sink	81.94	52.94		239
Cold Water—Bathroom	–30.62	45.63		22
Cold Water—Running from Laundry Tub	–150.89	169.34		76
Cold Water—Running from Kitchen Sink	–1.68	41.85		205
Cold Water—Running from Bathroom	–213.25	458.32		9
Hot Water—Kitchen Sink	461.80	382.98		26
Hot Water—Running from Kitchen Sink	209.91	342.79		26
Kettle Water	77.98	84.68		12

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Report of the lead data analysis task force.

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